OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

FIELD OPERATIONS PLAN

Prepared For

Occidental Chemical Corporation

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FIELD OPERATIONS PLAN

1.0 INTRODUCTION

1.1 Purpose

The Field Operations Plan (FOP) for the Hooker/Ruco site has been developed to provide a detailed description of the scope-of-work, onsite investigation methodologies and protocols, quality assurance/quality control and health and safety requirements. The FOP has been prepared in accordance with the agreements stated in the Administrative Consent Order (ACO) between Occidental Chemical Corporation (OCC) and the United States Environmental Protection Agency (USEPA). The format of the FOP follows the guidelines outlined by "Draft Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA" dated March 1988.

1.2 Format

The format of the FOP is divided into the following sections: Section 1 is the introduction; and Section 2 is the field investigation. The field investigation contains the tasks for the remedial investigation. Section 3 contains the Health and Safety Plan (HASP); and Section 4 contains the Quality Assurance/Quality Control Plan (QA/QC).

1.3 Project Team

The Project Team which will conduct the FOP follows, and indicates responsibilities and chain-of-command. The curricula vitae are shown in Appendix A. The laboratory which will perform all analyses will be Radian Corporation of Austin, Texas. Radian conforms to all Contract Laboratory Protocols.

Remedial Investigation

Site Coordinator	Dr. Alan Weston (OCC)
Project Officer	Robert Lamonica, Leggette, Brashears & Graham, Inc. (LBG)
RI Leader	William T. West, LBG
LBG Onsite Geologist	Edward J. Destefanis, LBG
LBG Health and Safety Officer	Douglas E. Simmons, LBG
LBG Geochemist	Dale Braue, LBG
QA Manager	T. Yagley, OCC

Feasibility Study

Project Officer	Robert Lamonica, CPG
FS Leader	William K. Beckman, LBG
FS Engineer	Laura Hanson, LBG
Health and Safety Officer	Douglas E. Simmons, LBG

2.0 FIELD OPERATIONS PLAN

Phase I:

2.1 Monitoring Well Installation

The Phase I ground-water program is designed to characterize and delineate possible chemical transport, both vertically and horizontally near the Hooker/Ruco site. Data obtained from this program will also be used to complete the characterization of aquifer parameters such as ground-water flow direction and subsurface stratigraphic units. Figures 1 and 2 present the proposed Phase I on and offsite monitoring well installation locations.

Eight well clusters, each consisting of a shallow well (total depth about 65 feet) and a deep well (total depth about 130 feet) and a deep sampling borehole will be installed. Each of the above wells will be installed in a separate borehole. In addition, four shallow monitoring wells will be installed to determine the chemistry of the water directly downgradient of three former or present recharge basins and one currently used tank farm. Two additional shallow wells, Q-1 and R-1 will be installed downgradient of the identified location if reported buried tanks or trailers are detected in the geophysical (electromagnetic) survey.

At each cluster location, a deep sampling borehole first will be drilled downgradient of the well locations. The sampling borehole will be drilled using a mud-rotary drilling rig and the drilling fluid will consist of bentonite and water. Split-spoon sampling using a 3-inch diameter carbon steel split spoon will provide the stratigraphic information needed to determine the proper screen depths for the shallow wells. After the borehole is drilled to the desired depth, the hole will be backfilled with a bentonite-cement slurry (15 percent - 85 percent) and sealed with a 3-foot diameter cement cap. The slurry will be emplaced using a tremie pipe to ensure complete sealing. Following completion of the

sampling borehole, a shallow and deep well will be completed at the cluster location. The wells will be drilled with a hollow-stem auger and be completed adjacent but upgradient of the sampling borehole. Deep wells will have a 10-foot screen from approximately 120 to 130 feet. Each shallow well will have a 15-foot screen extending from approximately 5 feet above the water table to 10 feet below it.

Materials to be used in well construction will include:

- pre-cleaned, 2-inch stainless-steel, wire-wound screen, 10 to 15 feet in length, with 0.020-inch slot openings and flush-joint threads, and 2-inch Schedule 304 stainless-steel riser pipe;
- graded, clean Morie (99.4 percent SiO_2) sand filter pack;
- bentonite seal;
- cement-bentonite grout; and
- 6-inch security casings and locks.

The shallow and deep wells will be installed in accordance with the following general procedure:

A. We will be using a new type of hollow-stem auger rig called an F-10 (made by the Failing Company). It has twice the power of any other hollow-stem auger rig and is capable of drilling 130 feet and 80 feet into the water table.

B. The site geologist(s) will determine monitor well depths based on the stratigraphic log developed from the deep well borehole. The deep well will be screened at a depth of 120 to 130 feet unless a clay layer over 1-foot thick is detected in the screened interval. If clay is present, the first 10 feet of sand below the clay will be screened. The shallow wells will have a 15-foot screen extending from approximately 5 feet above the water table to 10 feet below it.

C. The stainless-steel screen will be set 1 foot from the bottom of the borehole with sufficient riser pipe to extend from the top of the screen to 2 feet above the ground surface.

D. The annular space will be filled from the bottom of the well to 2 feet above the top of the screen with clean Morie No. 1 sand or equivalent. A weighted steel tape will periodically be placed down the annulus to ensure the gravel pack comes 2 feet above the screen. A bentonite seal at least 2 feet thick will be placed above the sand, and the remaining annular space will be filled with a bentonite-cement slurry (15 percent to 85 percent), using a tremie pipe.

E. A security casing with locking cap will be installed for each well.

F. A 3 to 4-foot diameter cement pad will be constructed around the security casing and mounded in such a way as to direct surface runoff from the casing (figure 3). The security casing will be locked.

The monitoring well construction and installation will not be considered complete until each well is properly developed. Well development is intended to clear the well screen and sand pack of fine material which may clog the screen, and to stabilize the formation material immediately surrounding the well screen. The wells will be developed by pumping and surging. The surging may be done by periodically pumping, or with a surge block. This will help to avoid bridging of the formation materials and will permit a more uniform flow through the well screen.

The well will be developed and the site geologist will monitor pumping rates, water color and turbidity, pH and conductivity to determine the effectiveness of the development. Well development will be considered complete

when turbidity measurements indicate that the discharge has 50 NTU's (Nepheolometric Turbidity Units) or less. Because past investigations have determined that there are low levels of onsite ground-water chemistry, and because there are no confining layers between the Glacial and Magothy aquifers, the development water will be discharged into a sump previously used to dispose of waste water, allowing the water to return where it originated. Following installation of the wells, the elevations of the ground surface and the tops of the riser pipes and security casings will be surveyed from Nassau County Benchmark (BM 14S07 G518) located along Oyster Bay Road.

2.2 Formation Sampling

Split-spoon formation sampling for geologic characterization will be continuous from land surface to a depth of 10 feet and continue at 5-foot intervals to completion of the boring. The split-spoon sampler will be a 3-inch diameter, rust-free carbon steel Lynex, or equivalent, sampling device. Shallow borings adjacent to deep borings will not be sampled because all necessary data will be provided by the deep borings. A representative portion of each split-spoon sample will be placed in a labeled clean glass jar and analyzed by a TIP or HNU photoionization detector or equivalent, calibrated daily according to Appendix B, by the head-space analysis described in Appendix C. The samples for analytical tests will be taken at the surface (0 to 2 feet), at a depth of approximately 10 to 12 feet and above the water table (approximately 50 to 52 feet). If a 5-ppm (parts per million) concentration results from the head-space analysis of a split-spoon sample or visual observations of stained soils are made, the samples will be tested also. All samples for analysis will be homogenized in the field as specified in Appendix K, except for the volatiles portion. A determination of sample disposition will be made within 5 minutes, during which time the split spoon will be

kept closed. Any of the soil samples described above for analytical testing will be analyzed for the Target Compound List (TCL) (Section 4), and Tentatively Identified Compounds (TIC's) using Contract Laboratory Protocol (CLP) methodology. MOCA (4,4-methylene-(bis)-2-chloroaniline) will also be analyzed. The soil sampling equipment including homogenizing tools will be cleaned with procedures outlined in Appendix L. Field blanks will be collected from the soil sampling equipment to ensure that cleaning procedures have been adequately completed. Field blanks will consist of pouring demonstrated analyte-free deionized water through the sampling equipment and collecting the runoff in appropriate laboratory containers. Field blanks will be collected from each piece of sampling equipment; split spoons, pans and spatulas used for sample homogenization, and will be collected at the beginning of each work day that the equipment is used. Field blanks will be analyzed for all TCL parameters using CLP methods, MOCA and TIC's. The field blanks will be sent for laboratory analysis with the samples collected that day.

2.3 Equipment Decontamination

All of the drilling equipment that comes in contact with the boring (augers, steel casing, rods, tools, etc.) will be steam cleaned between each boring. A decontamination pad will be set up in a central location and used throughout the entire field investigation. The decontamination pad will be designed with polyethylene sheeting and berms to collect the decontamination water. Once collected the water will be tested to determine the proper disposal.

2.4 Disposal of Soil

Any split-spoon soil sample that has a concentration of 5 ppm or greater resulting from the head-space analysis will trigger the "containerizing of drill cuttings". All of the cuttings removed from the borehole will then be containerized until a split-spoon sample has a concentration less

than 5 ppm resulting from the head-space analysis, at which time the cuttings will not be containerized but distributed evenly around the surface of the well. Any split-spoon sample that exceeds 5 ppm from the head-space analysis will also be analyzed by the Toxicity Characteristic Leaching Procedure (TCLP) which will indicate the proper disposal method.

2.5 Geophysical Logging

When the deep borings are drilled to the proposed depths, each borehole will be geophysically logged by the gamma method. The gamma log measures the radiation of gamma rays from certain radioactive elements that occur naturally in subsurface clay formations. Low intensity gamma-ray activity indicates a sand layer. Between uses, the downhole equipment will be cleaned with soap and water with a final rinse with deionized water.

2.6 Water-Level Measurements

Water-level measurements will be taken from the new and previously installed wells on a bimonthly basis for the duration of the field investigation. Three water-level recorders will be set up on two water-table wells and one deep well to record daily fluctuations for a one-month period.

2.7 Ground-Water Sampling

Ground-water samples will be obtained from the 39 existing and proposed onsite and offsite wells shown on figures 1 and 2. The samples will be analyzed for all TCL parameters, MOCA and TIC's using CLP methodology. Non-filtered samples will be collected for all analyses. Filtered samples will be collected for metals analysis if the ground water contains observable sediment. These will be analyzed at the discretion of OCC. The procedure to collect filtered metal samples is presented in Appendix F.

Three onsite well pairs A-1, A-2, C-1, C-2 and K-1, K-2 will also be analyzed for biological oxygen demand (BOD), total organic carbon (TOC), oil and grease, alkalinity, total suspended solids (TSS), total dissolved solids (TDS), hardness, chloride, sulfate and chemical oxygen demand (COD). Field measurements will be made for pH, specific conductance and temperature with instruments calibrated as outlined in Appendices D and E. All wells will be allowed to stabilize from the installation for a minimum of two weeks prior to sampling. The wells will be sampled according to the protocol outlined in Appendix F and, noting sample holding times in Appendix G. Replicate ground-water samples will be collected at a rate of 10 percent. Trip blanks, consisting of demonstrated analyte-free water and sealed in 40 ml septum vials will be transported into the field where sampling for volatile organics in an aqueous matrix occurs. Trip blanks will be collected at a frequency of one per day. The sampling equipment will be cleaned according to the protocol outlined in Appendix H. Field blanks will be collected from the sampling pump to assure that the cleaning procedures have been adequately completed. The field blank will consist of inserting the cleaned sample pump into a section of dedicated 2-inch diameter stainless-steel casing with a bottom plug. After the pump has been installed into the casing, the casing will be filled with demonstrated analyte-free deionized water and the pump will then be turned on. The field blank will be collected from the pump's discharge and placed in appropriate laboratory containers. Field blanks will be collected each day that the ground-water sampling equipment is used. Field blanks will be sent for laboratory analysis with the samples collected that day. All field blanks will be analyzed for all TCL parameters using CLP methods, MOCA and TIC's. The purged water from all of the wells will be discharged to the ground surface in a sump and allowed to return to the water table where it originated.

2.8 Hydrogeologic Characterization

Two piezometers constructed of stainless-steel will be installed in order to better define ground-water flow direction within the upper water-table aquifer. The piezometer locations are shown on figure 2. In addition to the new piezometers, two offsite wells, P-3 and P-4 will be utilized for ground-water measurements. The existing wells are located to the east of the Ruco site on Grumman property and their locations are also shown in figure 2. Soil and water samples will not be taken at the piezometer locations. The screened portion of the piezometer will extend from approximately 5 feet above to 10 feet below the water table. All of the peizometers will be surveyed to determine their elevation from Nassau County Benchmark (BM 14S07 G518) located along Oyster Bay Road. These piezometers will be installed identically to the ground-water monitoring wells.

2.9 Air Monitoring

Air monitoring will be conducted for particulates, Aroclor 1248 on particulates and specific volatile organic compounds on two occasions: once prior to commencement of field activities and once during field activities. The exact locations will be determined in the field, but will include one upwind and two downwind locations, with one downwind location sampled in duplicate during both events. Monitoring will be conducted at a respirable height (4 to 6 feet above ground) according to NIOSH methods. The meteorological station at the Grumman airfield will provide necessary information regarding wind speed and direction and relative humidity. All relevant air monitoring data will be recorded on the worksheets attached in Appendix 0, each time air sampling occurs.

2.9.1 Air Monitoring - Particulates

Air monitoring of total particulates will be conducted utilizing a flow controlled personal sampling pump and a tared 37 mm, 5 um PVC filter as described in NIOSH

Method 0500. The personal sampling pump will be a DuPont ALPHA-1 air sampler or equivalent. The ALPHA-1 pumps are user programmable for start time, run time, tolerated low-flow time, and intermittent run time as well as user flow rate selectable from 5 cc/min to 5,000 cc/min without requiring the use of critical orifices. The pumps will be used at a flow rate of 1,500 to 2,000 cc/min as specified in NIOSH Method 0500.

Collection filters utilized for particulate sampling will be SKC 37 mm, 5 um pore size, polyvinyl chloride (PVC) filters, or equivalent and will meet the requirements of NIOSH Method 0500.

Collection filters for the measurement of total particulates will be gravimetrically analyzed for total mass according to NIOSH Method 0500. The filters will be pre-numbered, desiccated and weighed on a microbalance capable of weighing to 0.01 mg. The filters will then be used for collection, desiccated again and re-weighed. The resulting change in weight will be calculated and the concentration in mg/m^3 will be reported.

Air sampling for particulates and specific pump calibration will be completed with procedures outlined in Appendix O.

2.9.2 Air Monitoring - Specific Volatile Organic Analysis

The analysis for specific volatile organics will be conducted utilizing a flow controlled air sampling pump as described in NIOSH Method 1003. The air sampling pump will be a DuPont ALPHA-1 air sampler or performance equivalent. The ALPHA-1 pumps are user programmable for start time, run time, tolerated low-flow time, and intermittent run time as well as user flow rate selectable from 5 cc/min to 5,000 cc/min without requiring the use of critical orifices. The pumps will be operated at 50 cc/min over an eight-hour workday and between 10 and 15 liters of air will be collected. These operating parameters are based on the low

breakthrough volume of vinyl chloride. The pumps will be calibrated for flow rate utilizing a Teledyne-Hastings NBS traceable bubble meter or performance equivalent.

Carbon disulfide will be used to desorb chemicals from the charcoal tubes. The analysis will employ a gas chromatograph equipped with a flame ionization detector. The following chemicals will be analyzed for:

Trichloroethylene
Tetrachloroethylene
Vinyl Chloride
Trans-1,2-Dichloroethylene

Concentrations above 1 ppm - air equivalent - for each listed compound will be reported.

Charcoal tubes utilized for specific volatile organic air sampling will be SKC charcoal tubes, 400 mg x 200 mg or equivalent and will meet or exceed the requirements of NIOSH Method 1003.

QA/QC will consist of analysis of a field blank which is an unopened charcoal tube taken into the field during each sampling event and returned to the laboratory. The laboratory will determine desorption efficiency by spiking all four compounds of interest on to a blank tube and desorbing with carbon disulfide. The desorption efficiency will be determined as per NIOSH Method 1003.

Collection of the air samples for volatile organics and specific equipment calibration will be completed in accordance with procedures outlined in Appendix O.

2.9.3 Air Monitoring-Aroclor 1248 on Particulates

The analysis for Aroclor 1248 on particulates will be conducted utilizing a flow controlled air sampling pump as described in NIOSH Method 5503. The air sampling pump will be a DuPont ALPHA-1 air sampler or performance equivalent. The ALPHA-1 pumps are user programmable for start time, run time, tolerated low-flow time, and intermittent run time as

well as user flow rate selectable from 5 cc/min to 5,000 cc/min without requiring the use of critical orifices. the pumps will be used at flow rates between 500 and 1,000 cc/min for NIOSH Method 5503. They will be calibrated for flow rate utilizing a Teledyne-Hastings NBS traceable bubble meter or performance equivalent.

Hexane will be used to desorb chemicals from the glass fiber filters. The analysis will employ a gas chromatograph equipped with an electron-capture detector. The following chemical will be analyzed for: Aroclor 1248. Concentrations above 0.01 mg/m^3 will be reported.

Glass fiber filters utilized for Aroclor 1248 on particulates air sampling will be 13 mm glass fiber filters or equivalent and meet the requirements of NIOSH Method 5503.

QA/QC will consist of analysis of a field blank, which will be an unopened filter taken into the field and returned to the laboratory for analysis. Desorption efficiency will also be determined by spiking Aroclor 1248 onto the filter media and desorbing according to NIOSH Method 5503.

Air sampling for Aroclor 1248 on particulates and specific equipment calibration will be completed with procedures outlined in Appendix O.

2.10 Geophysical Survey

A geophysical investigation consisting of an electromagnetic terrain conductivity survey will be conducted onsite to locate features such as trailers and tanks which are believed to be buried onsite. If the tanks can be located more rapidly, the entire grid will not be surveyed.

Data will be referenced to a site grid of approximately 20-foot spacing. Stakes or spray paint (paved areas) will be used to mark each grid point. All underground structures detected by the survey will be marked and staked to avoid encountering these structures during soil sampling and monitoring well installations.

The electromagnetic conductivity survey will be performed along a series of traverses running east-west across two areas of the site (figure 4) where tanks or trailers are believed to be buried. The EM-31 will be calibrated according to the procedures outlined in Appendix J. A total of approximately 850 stations will be occupied using an EM-31 electromagnetic terrain conductivity meter or equivalent. Line spacings, established from the grid points, will be 20 feet apart. Station spacings will be 20 feet along each traverse.

Data generated from the electromagnetic survey will be used to locate two proposed soil sampling and monitoring well locations downgradient of the buried tanks. At this time much of the area targeted for the survey is covered by cars and surrounded by a chain link fence. These interferences will be removed if the tanks cannot be located outside this area.

2.11 Surface-Water Sampling

A total of three surface-water samples will be collected at locations specified in figure 1 from the two onsite sumps still containing water, Sumps 3 and 4. Samples will be analyzed for all TCL parameters, TIC's and MOCA using CLP methodology. Measurements of pH, specific conductance and temperature will be made in the field at the time of sample collection. Samples will be obtained by wading into the sump, allowing sediments to settle, and then opening the sample containers one foot below the water level. The container will be closed under water and wiped clean at the surface.

2.12 Soil-Gas Survey and Surface Soil Sampling

In order to determine if there are any soils with significant chemistry which could potentially degrade the ground water, a soil-gas survey will be conducted at all unpaved areas of the site. The soil-gas survey will be

completed on dry days, preferably after two consecutive dry days, in order to avoid potential interferences caused by humidity in the samples. A portable Sentext Scentograph Gas Chromatograph/Argon Ionization Detector (GC/AID), or equivalent, and a TIP Photoionization Detector (PID), or equivalent, will be used to complete the soil-gas survey. The soil-gas survey will be performed along a series of traverses running east-west across the site. The GC/AID will be used to complete sample analysis at 100-foot spacings along every other traverse. The GC/AID will be calibrated daily with a custom can mix of trichloroethylene (0.976), tetrachloroethylene (0.916), trans-1-2-dichloroethylene (0.955) parts per million by volume in nitrogen of calibrant gas manufactured by Scott Specialty Gases, Inc. or a performance equivalent according to Appendix I. The TIP PID will be used at 50-foot spacings along each traverse. A grid map showing the location of the soil-gas sampling points and the corresponding survey method is shown on figure 5.

Sampling locations surveyed by the TIP PID will be used to identify total ionizable compounds calibrated to isobutylene daily according to Appendix B. Soil-gas samples analyzed by the GC/AID will be used to identify trans-1-2-dichloroethylene, trichloroethylene and tetrachloroethylene as well as total concentrations of volatile organics. If concentrations in excess of 5 ppm above background are identified, then soil samples will be collected and analyzed for TCL parameters, MOCA and TIC's using CLP methodology.

The soil-gas samples will be collected in the following manner. Cleaning of the soil-gas sampling equipment will be completed after each use to avoid cross contaminating. A slide hammer bar, cleaned in accordance with procedures outlined in Appendix L will be used to create a ½-inch diameter 3-foot vertical hole at each sampling location. A 4-foot long, stainless-steel sample probe, cleaned in accordance with procedures outlined in Appendix L and purged

with 1.25 liters of ultra high purity Argon, will be placed in the hole and used as a sampling probe. The sampling probe will be sealed with bentonite to prevent ambient air from entering the sample probe and a Teflon tube will be attached to the sample probe. The Teflon tube will then be connected to a peristaltic pump and the pump will be run until a 1.25 liter BGI, Incorporated Tedlar bag or performance equivalent is full (approximately 20 volumes of the sample probe). If the location is to be surveyed using the TIP PID, then the Teflon hose will be attached directly to the instrument and a reading will be taken. Samples surveyed using the GC/AID will be collected by inserting a sampling needle through the Teflon hose and a sample will be injected into the GC/AID using the GC's internal sampling pump. Analysis of samples surveyed with the GC/AID will be completed using a purge and trap sampling loop and an Argon Ionization Detector (AID), operated by a Toshiba T 1100 plus LCD lap-top computer.

Background readings will be established daily, and all deflections greater than background will be recorded (usually 1 to 2 ppm). However, if a 5.0 ppm reading is obtained from the soil-gas survey, the area will be defined with additional soil-gas samples. Subsequently, one soil sample will be collected from the 0 to 3-foot interval in the defined area and retained for laboratory analysis of full TCL parameters, TIC's and MOCA using CLP methodology.

2.13 Subsurface Sampling (Shallow Borings)

In addition to those samples collected from the monitoring well borings, shallow subsurface soil borings will be drilled at 40 onsite locations (figure 6). The borings will vary in depth from 5 to approximately 30 feet. Figure 5 also shows the number of samples (two or three) to be obtained for analysis at each location. All soil samples to be tested will be analyzed for MOCA, and all TCL compounds and TIC's using CLP methodology. All of the soil samples

will be collected according to the protocol outlined in Appendix K with the sampling equipment cleaned according to the protocol outlined in Appendix L. Soil sample duplicates will be collected at a rate of 10 percent.

The soil sampling locations have been chosen to provide data in areas of past discharge, or storage, and in two onsite areas where materials are currently stored in above-ground tanks. In each shallow boring continuous split-spoon samples will be taken and subjected to a head-space analysis and the readings recorded. The following paragraphs describe the samples to be taken at each boring location.

A. Sump 1 has been partially backfilled, but contains a concrete tank used as a settling basin to hold liquid wastes prior to incineration. Two borings will be made in opposite corners of the sump and at least three samples taken at each location. The boring will be completed to a depth of at least 10 feet below the former sump bottom. Samples selected for analysis will be based on the following: 1) if high TIP readings are encountered the sample with the highest reading, 2) one sample representative of the sediments above the sump bottom, 3) and one sample 5 feet below the sump bottom, and 4) if the sample from 10 feet below sump bottom shows a high TIP reading, it should be tested. If the sump bottom cannot be identified then the boring should be continued to a depth of 45 feet below the surface. Three samples with the highest head-space readings will be selected for analytical testing. In addition, if they are not included in these three, one from below 30 feet will be analyzed, and a visibly stained sample (if any) will be analyzed.

B. Sumps 2, 3 and 4 have not been backfilled, and Sumps 3 and 4 still contain water. Two borings will be drilled on opposite sides of the bottom of

each sump (in Sump 4, from opposite sides of the internal berm) and drilled to a depth of 10 feet. Samples for analytical testing will be taken at depths of 0 to 2 feet, 4 to 6 feet and 8 to 10 feet below the level of the top of sediments in the sumps.

C. Sumps 5 and 6 have been completely backfilled. Three borings will be made in Sump 5 and two in Sump 6. Each boring will be completed to approximately 30 feet below grade. If the sump bottom cannot be identified, then the boring will be continued to 45 feet below the surface. Three soil samples with the highest head-space reading will be selected for laboratory analysis. In addition, if the samples are not already included for analytical testing, one sample will be collected below 30 feet and a visible stained (if any exist) sample will be analyzed.

D. Drums were stored along the fence to the east of Plant 2. This area may have been scraped to remove surface soil. Soil samples will be taken at four locations in this area approximately 20 to 30 feet from the eastern boundary of the site. Soil samples will be taken at a depth of 0 to 2 feet and 3 to 5 feet at each location.

E. The current Drum Storage Area is also on the eastern side of Plant 2, on a concrete pad. Six borings are located on and around the pad. Two additional borings will be drilled on the south side of Plant 2 where there is additional drum storage. Soil samples will be taken at a depth of 0 to 2 feet and 3 to 5 feet at each location.

F. The storage tank area in the north-central part of the plant will be the site of three soil borings to determine the effects of past and current usage

on soil quality. Soil samples will be taken at a depth of 0 to 2 feet and 3 to 5 feet at each location.

G. In the southeastern corner of the plant there is an above-ground storage tank area. Two borings will be drilled to depths of 5 feet below grade. Soil samples will be taken at a depth of 0 to 2 feet and 3 to 5 feet at each location.

H. Underground storage tanks were formerly present near Plant 1. Four soil borings to depths of 10 feet below the base of the former tanks will be made, two in each of the two old tank farm locations. Samples to be analyzed will be taken from below the soil/fill interface, and at a depth of 13 to 15 feet. If the tank bottoms cannot be located then the boring will extend to a depth of 20 feet and samples selected based on head-space analyses or visible soil contamination.

I. In the PCB spill area, five borings were to be drilled to supplement and confirm the results of previous work. During the month of September an underground storage tank which contained fuel oil was excavated by Ruco Polymer Corporation. Because of this, and because of additional studies conducted by OCC since preparation of the Work Plan, two of the borings planned for this area have been relocated to the north side of Plant 1. Also, the soil removed from the tank excavation was placed in seven piles identified as Piles A-G. The piles of soil were placed on plastic as well as covered by plastic. The locations of these piles are identified on figure 7. Soil samples were collected from these piles and are in the process of being analyzed for PCB's. The results of the analysis will indicate the method of disposal.

Soil samples will be obtained from each boring at depths of 1 to 3 and 3 to 5 feet below grade, and will be analyzed for PCB's, volatile TCL's, volatile TIC's and TCL metals. The two borings completed near Plant 1 will be sampled from below the depth of tank excavation.

2.14 Sample Summary

Table 1 presents a sample summary.

2.15 Applicable or Relevant and Appropriate Requirements (ARAR's)

Table 2 presents the ARAR's as presented in the Work Plan. Additional New York State Class GA ground-water guidance values will also be considered for the RI report. For the analytical program to adequately reflect these criteria, an alternate methodology to the CLP Protocols for volatiles will be used as stated in Section 4.

2.16 Schedule

The schedule for tasks described in this FOP is given on Plate 1. The starting date for the schedule is the date of official approval of the FOP by the USEPA. A close working relationship between the technical representatives of OCC, its contractor and the USEPA: 1) allows for timely resolution of problems, 2) assures that all parties are kept up-to-date, and 3) expedites the approval process for deliverables.

2.17 Phase II Investigation

Upon completion of the Phase I remedial investigation, the data generated will be analyzed to identify any potential data gaps. The Phase II remedial investigation will be designed in accordance with the ACO to fill these data gaps, if any, which will complete the hydrogeologic remedial investigation.

The Ebasco Work Plan specifies that local and regional ground-water data will be used to evaluate the ground-water exposure pathway. At the conclusion of the Phase I investigation it is anticipated that the direction and rate of ground-water seepage will be well understood. Consequently, analytical modeling, mentioned as an option in the Work Plan, should be sufficient to determine Phase II well location, should the need for such be determined.

Computer modeling of the ground-water system may become desirable when regional solutions to the ground-water problem are evaluated. Contaminant transport models would also require regional data, well beyond the bounds of an RI/FS which focuses only on the Hooker/Ruco site.

The need for modeling will be discussed with EPA after the results of the Phase I investigation are available.

2.18 Feasibility Study

Elements of the Feasibility Study (FS) will be conducted concurrently with the RI to insure that the necessary data is collected to properly evaluate remedial alternatives. These elements include:

1. development of remedial response objectives and general response actions;
2. identification and screening of remedial technologies;
3. development and screening of remedial alternatives; and
4. development of a work plan and field operations plan for removal of soils containing PCB's.

These are described more fully below, in sections taken from the Work Plan.

2.18.1 Development of Remedial Objectives and General Response Actions

Based on the data collected in the RI, the remedial response objectives will be developed more fully. Prior to

the development of these remedial response objectives, significant site problems and contaminant pathways will be identified. Considering these problems and pathways, the remedial response objectives which would eliminate or minimize substantial risks to public health and the environment will be developed further. This will include a refinement of the ARAR's with consideration given to site-specific conditions. Based on the remedial response objectives, general response actions will be delineated to address each of the site problem areas and to meet the clean up goals and objectives. These response actions will form the foundation for the screening of remedial technologies. General response actions considered should include the "no action" alternative as a baseline against which all other alternatives can be measured.

2.18.2 Identification of Applicable Technologies and Development of Alternatives

Based on the remedial response objectives and each identified general response action, potential treatment technologies and their associated containment or disposal requirements will be identified. A pre-screening of these potential treatment technologies for suitability as part of a remedial alternative will be conducted.

Technologies which may prove extremely difficult to implement, may not achieve the remedial response objective in a reasonable time, or are inapplicable and infeasible based on the site conditions, will be eliminated. It should be noted that this preliminary identification will be finalized based on the results of the RI and the establishment of remedial response objectives. A revised list of potential remedial technologies/alternatives may be developed, pending the outcome of this analysis.

The formulation of remedial alternatives requires combining appropriate remedial technologies, in a manner

that will satisfy the site remediation strategies or remedial response objectives which will be refined based on the results of the RI.

As required by SARA, treatment alternatives shall be developed in each of the following categories:

- an alternative for treatment that would eliminate the need for long-term management (including monitoring) at the site;
- alternatives for either a permanent solution, or the use of alternative treatment or resource recovery technologies;
- alternatives for treatment that, as their principal element, would reduce toxicity, mobility, or volume;
- an alternative that relies on containment, with little or no treatment, and
- a no-action alternative.

2.18.3 Screening of Remedial Alternatives

The list of potential remedial alternatives developed above will be screened. The objective of this effort is to eliminate alternatives principally on the basis of effectiveness and implementability. Alternatives will be eliminated, as described in the NCP Section 300.68 (g), that:

- may have significant adverse impact during implementation;
- do not adequately protect the environment and public health,
- have technical feasibility which is either difficult or not proven; and
- have costs an order of magnitude greater than other alternative(s) but do not provide greater environmental or public health benefits or greater reliability.

According to the above NCP screening criteria and SARA requirements, the initial screening of remedial alternatives

will identify alternatives as acceptable/unacceptable based on the following screening factors:

- Technical Feasibility Screening. Remedial alternatives will be evaluated based on performance, long-term reliability, effectiveness, implementability, operation and maintenance and safety considerations. Alternatives that are not compatible with site and waste source conditions, including those that might be difficult to construct under existing site conditions, will be eliminated.

  Innovative technologies will be considered through the screening if there is a reasonable belief that they offer potential for better treatment performance or implementability, few or lesser adverse impacts than other available approaches, or lower costs than demonstrated technologies.

- Environmental, Public and Institutional Screening. The purpose of these screening criteria is to eliminate alternatives with significant adverse impacts or alternatives that do not adequately remove the threat to the environment, public health, or welfare. Each alternative will be evaluated in terms of the effects that compliance with institutional issues will have on the implementation of that alternative.

- Cost Screening. Estimates of the cost of implementing the various alternatives will be developed for comparison of relative magnitude only. The alternatives whose costs are an order of magnitude higher than those of other alternatives but that do not provide significantly greater environmental or public health benefits will be eliminated. The cost screening will not be used to compare treatment and nontreatment alternatives, but will be

used for comparison of treatment technologies.

Costs will be estimated to achieve an accuracy within -50 percent to +100 percent. The screening costs of remedial technologies will be based on capital and on operating and maintenance (O&M) costs. After developing screening cost data, a present-worth analysis will be performed for both the capital and other expenditures.

2.18.4 Removal of Soil Containing PCB's

It has already been determined that soils containing PCB's in the pilot plant vicinity will be excavated and disposed of offsite. During the RI a Work Plan for implementation of this task will be developed. The Work Plan will contain a Field Operations Plan, Health and Safety Plan, and a Quality Assurance/Quality Control Plan.

3.0 HEALTH AND SAFETY PLAN RUCO POLYMER CORPORATION SITE HICKSVILLE, NEW YORK

3.1 Purpose, Scope and Objectives of the Health and Safety Plan

This Health and Safety Plan (HSP) is intended to provide a basic framework for the safe conduct of the field investigation conducted at the Ruco Polymer Corporation site in Hicksville, New York. The procedures provided herein are intended as a guide for all OCC contractor employees who will be involved in the performance of the project.

The primary objective of the HSP is to establish work-safety guidelines, requirements and procedures before field activities begin. The following information was prepared specifically for field operations by personnel assigned to this investigation. All personnel are required to enforce and adhere to the established rules as specified in the HSP. The approved HSP will be made available to all personnel to aid in accomplishing the following objectives:

A. monitoring the effectiveness of the HSP as it is conducted in the field by performing field operation audits;

B. following up on any necessary corrective actions;

C. interacting with USEPA field representatives regarding modifications of health and safety actions; and

D. stopping work should work-site conditions warrant such action.

The Ruco Polymer Corporation property and the Grumman Corporation are active industrial facilities with inherent hazards not related to the planned remedial investigation activities. The Ruco plant Health and Safety Officer, Dr. Bradley Harrison, and the Grumman plant Health and Safety Officer will be consulted prior to onsite activity on the respective properties to determine if any safety precautions should be taken in addition to those mentioned herein.

All personnel will have had health and safety training in accordance with OSHA Interim Final Standard 29 CFR 1910 or as may be amended.

3.2 Organization and Responsibilities

The organization and responsibilities for implementing safe site-investigation procedures, and specifically for the requirements contained in this manual, are described in this section.

3.2.1 Project Manager

The LBG Project Manager, Mr. Robert Lamonica will be responsible for the overall implementation and monitoring of the health and safety program by:

A. ensuring appropriate protective equipment is available and properly used by all personnel, in accordance with the HSP;

B. ensuring personnel health and safety awareness by providing them with proper training and familiarity with procedures and contingency plans;

C. ensuring all personnel are apprised of potential hazards associated with the site conditions and operations;

D. supervising and monitoring the safety performance of all personnel to ensure their work practices are conducted in accordance with the HSP;

E. correcting any work practices or conditions that would expose personnel to possible injury or hazardous condition;

F. communications with the onsite Health and Safety Officer;

G. ensuring sufficient protective equipment is provided and used;

H. promptly initiating emergency alerts; and

I. communicating with the Project Manager.

3.2.2 Onsite Health and Safety Officer

The onsite Health and Safety Officer for this project will be Mr. William T. West who will also supervise the field program. In addition to the duties described in the Scope of Work, Mr. West will be accountable for the direct supervision of personnel from the drilling contractor and other personnel with regard to:

- health and safety program compliance;
- maintaining a high level of health and safety consciousness among employees at the work site; and
- reporting accidents within his jurisdiction and undertaking corrective action.

3.2.3 Field Personnel

All field personnel will report directly to Mr. West the onsite Health and Safety Officer and will be required to:

- be familiar with, and conform to, provisions of the HSP;
- ensure that they are well informed of potential hazards at the work site and exercise informed consent in their work;
- report any accidents or hazardous conditions to the onsite Health and Safety Officer; and
- have complete familiarity with their job requirements and the health and safety procedures involved.

A meeting will be held with all field personnel, prior to initiating any onsite activity, to inform workers of potential hazards and to make sure they understand the HSP. Additional meetings will be held to discuss any changes in normal operating procedures or to disseminate new information which may have a bearing on health or safety.

3.3 Hazard Evaluation

The possible presence of vinyl chloride, tetrachloroethylene, 1,2 transdichloroethylene and trichloroethylene in the ground water and PCB's in the soil comprise the major concerns for personal health. The protection of personnel from exposure to these substances by inhalation, oral ingestion or dermal absorption is included as a primary purpose of this plan.

The potential inhalation and explosive hazards are shown on table 3. Also shown in this table are the Permissible Exposure Limit, Immediately Dangerous to Life or Health (IDLH) Level, Lower Explosive Limit (LEL), and Upper Explosive Limit (UEL), for the suspected volatile organic hazards. Symptoms of overexposure, possible chronic effects and first aid treatment for the potential hazards are shown in table 3.

The onsite Health and Safety Officer is responsible for determining the level of personal protection equipment required. When work-site conditions warrant, the onsite Health and Safety Officer will modify the level of protection to be utilized in the field. The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated, will result in the suspension of work until the Project Manager has been notified and appropriate instructions have been provided to the field team.

3.4 Monitoring Requirements

A TIP Instrument, HNU or equivalent, will be used to monitor ambient air quality at the drilling sites. Records of these data will be maintained by the onsite Health and Safety Officer. During drilling operations, air quality will be monitored at each drilling location, especially near the top of the boreholes as samples are taken. Work operations which involve handling of potentially hazardous

substances will include continuous contaminant monitoring using the TIP Instrument.

When deemed necessary or desirable by the onsite Health and Safety Officer, area monitoring will be used in potentially hazardous zones. Area monitoring will be performed as plans and conditions dictate, and in accordance with the HSP and with the goal of accident and hazardous condition prevention in mind.

Because of the low breakthrough time for vinyl chloride in organic vapor cartridges, colorimetric tubes will be kept on hand to determine if VCM is a component of the ionizable compounds detected by the TIP.

3.5 Levels of Protection

The level of protection anticipated to perform work on this investigation is Level D. The protective equipment to be used by field personnel is listed below.

1. Level D

- hard hat;
- safety glasses or chemical splash goggles;
- boots/shoes, leather or chemical-resistant, steel toe and shank; and
- coveralls.

At a minimum, protective headgear, eyewear and footwear will be worn at all times by personnel working around the drilling equipment. Protective gloves and chemical-resistant boots will be required for those personnel handling soils or water containing PCB's, or as directed by the Safety Officer.

Should levels of organic vapor greater than 5 ppm above background levels be detected by the TIP Instrument in the work area, work will stop and all personnel will leave the work area. The onsite Health and Safety Officer in

consultation with the Project Manager and USEPA personnel will determine the advisability of continuing work in Level C protective equipment.

If levels as low as 1 ppm above background are registering on the TIP in the work zone, colorimetric tubes (Sensidyne or equivalent, Appendix M) will be used to determine if vinyl chloride is at levels which may require Level C or greater protection.

2. Level C

- hard hat;
- boots, leather, steel toe and shank;
- outer boots, chemical resistant;
- chemical-resistant gloves (solvex);
- Tyvek or Saranex suit; and
- Air purifying respirator with organic vapor cartridge and dust and mist filter, (full face).

Respirators for all personnel will be available with both particulate and organic vapor protection cartridges. The onsite Health and Safety Officer will direct when the protective clothing and respirators will be utilized based on the conditions encountered at the work site.

Only protective equipment deemed suitable by the onsite Health and Safety Officer for use at the work site will be worn. Any changes in protection levels shall be documented by the onsite Health and Safety Officer. Respirators will be cleaned daily and cartridges changed at least once per each eight hours of use. Field personnel should exercise informed judgment on protective equipment requirements at active work sites or at work sites that have been repeatedly entered or occupied without apparent harm. In any case where doubt exists, the safe course of action must be taken.

3. Level B

- pressure-demand, self-contained breathing apparatus;
- chemical resistant clothing (Saranax suit);
- outer gloves (Solvex);
- inner gloves (surgical);
- outer boots (chemical resistant);
- inner boots (leather, steel shank and toe);
- hard hat;

It is extremely unlikely, based on the extensive data available for this site, that Level B protection will be required. However, in the event that the work space atmosphere contains in excess of 1 ppm total ionizable compounds above background, colorimetric tubes, or a portable gas chromatograph, will be used to determine the levels of vinyl chloride. If vinyl chloride exceeds 1 ppm (8-hour safe exposure level), or if total ionizable compounds exceed 50 ppm above background, the use of Level B equipment will be considered. This determination will be made based on the specific compounds present and will include discussions with the EPA.

3.6 Safe Work Practices

In addition to the use of protective equipment, other procedures will be followed to minimize risk:

- all consumptive activities including eating, drinking or smoking are prohibited during the drilling, sampling and decontamination activities;
- emergency eye washes will be located near the work site during drilling and sampling activities;
- an adequate source of potable water for emergency use will be available at the drilling sites;
- fire extinguishers will be available at the work sites for use on equipment or small fires; and

- an adequate stocked first-aid kit will be maintained at the work site at all times during operational hours.

3.7 Work Zone

To prevent unauthorized personnel from entering areas where active drilling operations are being performed, the area enclosing the drill rig will be marked with flagging.

This zone will be entered in Level D protection. However, individual work sites within the zone may require higher levels of protection based on air monitoring results during the various activities. If this becomes the case, separate work sites will be established based on the level of protection required.

There are no areas that are considered confined or restrained so that they would require special precautions or equipment. Field personnel are instructed to leave the area if monitoring shows readings above the permissible exposure limits (see Section 4). Before conducting field work in respirators, the Project Manager will be contacted. A determination will be made by the onsite Health and Safety Officer and Project Manager if work is to continue with respirators. Factors which may influence this decision include the level of observed or suspected hazard, period of time required to complete activity and weather conditions.

3.8 Decontamination

An area will be set aside within the work zone for decontamination. The type of decontamination procedures used will be based on the level of protection required. Decontamination of Level D protective wear will consist of brushing heavily soiled boots to remove soils, rinsing gloves and safety glasses (and overboots, if worn) with water and removing and storing coveralls in plastic bags before leaving the work zone.

Level C decontamination, if required, will take place on plastic sheeting so all contaminated material can be contained for proper disposal.

LEVEL C DECONTAMINATION
(see figure 8)

PROCEDURE FOR DECONTAMINATION

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Suit/Safety Boot Wash

Thoroughly wash splash suit and safety boots. Scrub with long-handle, soft-bristle scrub and copious amounts of decon solution or detergent/water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes

Station 3: Suit/Safety Boot Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
2-3 long-handle, soft-bristle scrub brushes

Station 4: Canister or Mask Change

If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boots covers donned, and joints taped. Worker returns to duty.

Equipment: canister (or mask)
tape
boot covers
gloves

Station 5: Safety Boot and Outer Glove Removal

Remove safety boots and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 6: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
bench or stool
liner

Station 7: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit facepiece in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Station 8: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 9: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite since there is a possibility small amounts of contaminants might have been transferred in removing splash suit.

Equipment: container (30-50 gallons)
plastic liners

Station 10: Field Wash (optional)

Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
tables
wash basins/buckets
field showers

Station 11: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

LEVEL B DECONTAMINATION
(see figure 9)

PROCEDURE FOR DECONTAMINATION

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 3: Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 4: Suit/Safety Boot Wash

Thoroughly wash chemical-resistant splash suit, SCBA, gloves, and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water. Wrap SCBA regulator (if belt-mounted type) with plastic to deep out water. Wash backpack assemble with sponges or cloths.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes
small buckets
sponges or cloths

Station 5: Suit/SCBA/Boot/Glove Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
small buckets
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 6: Tank Change

If worker leaves Exclusion zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boots covers donned, and joints taped. Worker returns to duty.

Equipment: air tanks
tape
boot covers
gloves

Station 7: Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 8: SCBA Backpack Removal

While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.

Equipment: table

Station 9: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-to gallons)
plastic liners
bench or stool

Station 10: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Station 11: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 12: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite since there is a possibility small amounts of contaminants might have been transferred in removing fully encapsulating suit.

Equipment: container (30-50 gallons)
plastic liners

Station 13: Field Wash (optional)

Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
small tables
basins or buckets
field showers

Station 14: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

Equipment: tables
chairs
lockers
clothes

3.9 Emergency Contacts

In the event of a safety or health emergency, appropriate corrective measures must immediately be taken to assist those who have been injured or exposed and to protect others

from hazard. The onsite Health and Safety Officer will be notified of the incident immediately. If necessary, first aid will be rendered.

Should any situation or unplanned occurrence require outside or support services, the appropriate contacts from the following list should be made:

Ruco Polymer Corp.
(914) 942-0400, Extension 77 or 79
Safety Department . . . . . Dr. Bradley Harrison

Grumman Safety Department
(516) 575-3193. . . . . Mr. Jim Spencer

Leggette, Brashears & Graham, Inc.
(203) 762-1207
Project Manager . . . . . Mr. Robert Lamonica

Occidental Chemical Corporation
716-286-3607. . . . . Dr. Alan Weston

United States Environmental Protection Agency
(212) 264-7508. . . . . Douglas Tomchuck

Hicksville Fire Department
(516) 931-0026

Nassau County Police 8th Precinct
(516) 535-6800
(516) 535-6830

Central General Hospital Emergency Room
(516) 681-8900, Extension 2335

Ambulance and Police
911

3.10 Training

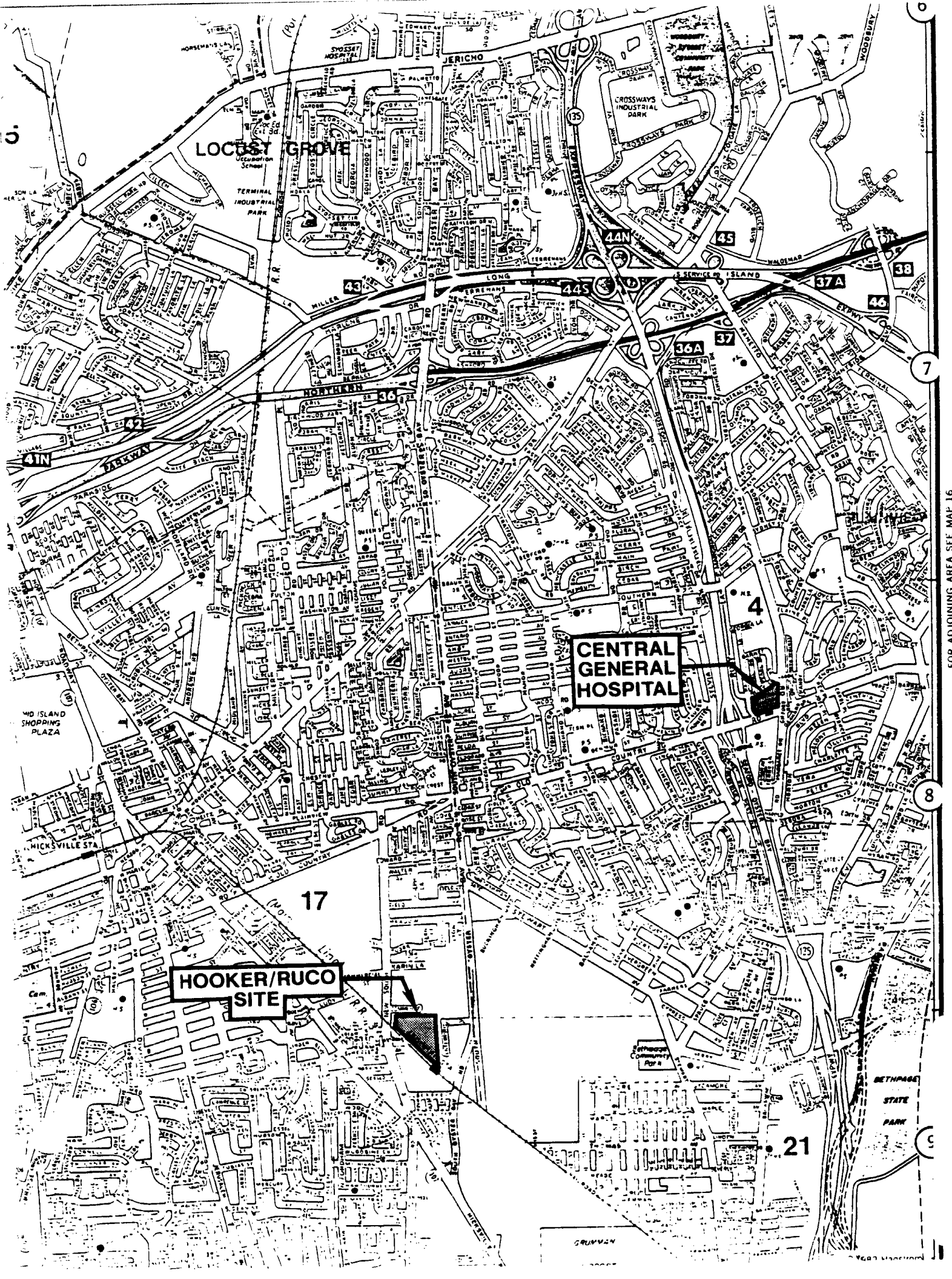
Each contractor and subcontractor will provide documentation to the onsite Health and Safety Officer that the field personnel have been trained in the proper use of protective clothing and equipment in accordance with 29 CFR Part 1910, including:

- purpose of wearing respirators;
- how the respirator works;
- limitations;
- fit testing;
- maintenance; and
- conditions of use.

All LBG, USEPA and drilling field personnel shall be made aware of the particular hazardous substances which could be encountered during this project.

3.11 Directions to Central General Hospital

Exit site and go north on New South Road to intersection with Old Country Road. Go east (right) to intersection with Central Park Road. Hospital is on northwest corner of the intersection. See map on next page.


LOCUST GROVE
JERICHO
CROSSWAYS INDUSTRIAL PARK
TERMINAL INDUSTRIAL PARK
NORTHERN
PARKWAY
LONG
ISLAND
EXPWY
CENTRAL GENERAL HOSPITAL
HOOKER/RUCO SITE
MID ISLAND SHOPPING PLAZA
HICKSVILLE STA.
BETHPAGE STATE PARK
GRUMMAN
17
21
4
FOR ADJOINING AREA SEE MAP 16

4.0 DATA COLLECTION QUALITY ASSURANCE PLAN

4.1 Introduction

This section presents guidelines and specifications which describe the quality assurance requirements for a Remedial Investigation/Feasibility Study (RI/FS) at the Hooker/Ruco plant site, to be performed pursuant to Section 122 (e) of CERCLA, 42 U.S.C. §9622 (e). It tracks the guidelines, specifications and definitions described in Guidance for Preparation of Combined Work/Quality Assurance Plans for Water Monitoring, Office of Water Regulations and Standards, USEPA, May 1984.

4.2 Data Collection Strategy

4.2.1 Project Description

OCC shall collect additional analytical data in two phases: in Phase I, from surface water, ground water and surface and subsurface soils at the Hooker/Ruco facility, located in the Town of Oyster Bay, Nassau County, New York. This data shall be sufficient to define the presence, magnitude and extent of any hazardous wastes and hazardous constituents not already defined, within and beyond the facility boundaries. Phase II will further evaluate the onsite sources (if necessary), the extent of contamination offsite, aquifer properties in contaminated areas, and the properties of contaminants which may affect the remedial alternatives available. This could include treatability or bench scale testing of remedial technologies.

4.2.2 Intended Use of the Data and the Necessary Level of Precision and Accuracy

Precision, the ability to replicate a value, and accuracy, the ability to obtain a true value, are addressed for all data generated. Data quality objectives for precision and accuracy are established for each major parameter to be measured at the site. The objectives are based on

prior knowledge of the capabilities of the measurement system to be employed, selected in accordance with the requirements of the project. The precision and accuracy requirements vary, depending upon their intended use. For example, a screening tool to identify the general extent of chemical distribution will not require the same precision and accuracy as might be required to define the exact nature and amount of chemicals present at specific locations.

Calculations performed with the data generated are also checked for accuracy and precision, i.e., comparability of calculation efforts between tasks, is assured by the Quality Assurance Officer (QAO). Accuracy and precision will be measured by the use of matrix spikes. Recovery objectives are based on those specified in applicable procedures of EPA guidelines methods. Standard practice is to use three times the standard deviation as a control limit and two times as a warning limit.

The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under normal conditions. The amount of valid data expected is established based on the measurements required to accomplish project objectives.

4.2.3 Project Organization and Responsibility

1.0 Project Organization

The project organization is presented in Section 1.3.

2.0 Definition of Responsibilities

a. The Analytical Program Manager (APM) is responsible for the following:

- selecting and reviewing all sampling and analytical protocols required for measuring and monitoring;
- selecting analytical laboratories;

- directing the activities of the external analytical laboratory used for the project;
- reviewing all QA/QC results with the QA officer; and
- has overall responsibility for management of the analytical program and the validity of all data.

b. The Analytical Quality Assurance Officer (QAO) is responsible for the following:
- reviewing and advising on all aspects of QA/QC;
- assisting the APM in specifying QA/QC procedures to be used;
- making QC evaluations to assist in reviewing QA/QC procedures, and, if problems are detected, making recommendations to the APM and to the External Laboratory Coordinator (ELC) to rectify the problem;
- evaluating and recommending corrections to sample custody procedures;
- informing the Project Manager that appropriate QA/QC procedures have been established and are being implemented by the proper personnel; and
- evaluating and recommending corrections in sampling and/or analytical techniques.

c. The ELC is responsible for the following:
- the laboratories activities;
- training and qualifying personnel in specified laboratory QC and analytical procedures, prior to receiving samples;

- informing the APM and/or QAO if any review of data quality appears to warrant repeat analysis of some or all samples;
- receiving samples from the field and verifying that incoming samples correspond to the packing list or chain-of-custody sheet;
- maintaining records of all incoming samples, tracking those samples through subsequent processing, analysis and ultimately, appropriate disposal of those samples at the conclusion of the project;
- preparing quality control samples for analysis prior to and during the program;
- preparing QC and sample data for review by the APM and QAO;
- review of raw data with laboratory chemists against calibration and QC records;
- approval of finished data; and
- preparing QC and sample data for transmission to the APM.

d. Sampling Coordinator

The sampling coordinator is responsible for the following:

- coordinating field activities and delivery of samples to the analytical laboratory;
- determining appropriate sampling equipment and sample containers to minimize contamination;

- trains and qualifies field personnel in sampling procedures and field analytical procedures prior to sampling;
- ensures that samples are collected, labeled, preserved, stored, transported, and, when necessary, filtered as specified in the procedures or protocols;
- checks that all sample documentation is correct and transmitted with the samples to the analytical laboratory and the APM;
- verifies that field analytical QC procedures are being followed as specified in the QA/QC protocol and prepares QC data for review by the APM and QAO; and
- participates in field analytical/ sampling quality audits with the APM and QAO.

4.2.4 Data Quality Assessment

The purpose of data quality assessment is to assure that data generated under the QA Plan are accurate and consistent with the Plan's objectives. The quality of data will be assessed based on precision, accuracy, consistency and completeness of the data that are measured or generated. Data quality assessment will be conducted in three phases:

Phase I: Prior to data collection, sampling and analysis procedures are evaluated in regard to their ability to generate the appropriate, technically acceptable information required to achieve QA Plan objectives. This QA Plan meets this requirement by establishing objectives defined in terms of parameters, analytical methods and required sampling protocols.

Phase 2: During data collection, results will be assessed to assure that the selected procedures are

efficient and effective and that the data generated provide sufficient information to achieve QA Plan objectives. Precision and accuracy of measurement systems will also be evaluated. In general, evaluation of data will be based on performance audits, results of duplicate and spiked sample analyses, and review of completeness objectives. Documentation will include, when applicable:

- number of replicate samples collected;
- number of replicate, spike and field blank samples analyzed;
- identification of statistical techniques, if used, to measure central tendency, dispersion, or testing for outliers;
- use of historical data and its reference; and
- identification of analytical method.

Phase 3: Following completion of each phase of data collection activities, an assessment of the adequacy of the database generated in regard to completing QA Plan objectives will be undertaken by the QAO and APM. Recommendations for improved quality control will be identified, if appropriate. In the event that data gaps are identified, the QAO or APM may recommend the collection of additional raw data to fully support the QA Plan's findings and recommendations. Each phase of the assessment will be conducted in conjunction with appropriate QA Plan staff.

All measurements will be representative of media and conditions. All data will be reported in consistent units to allow comparison with similar data. Data quality objectives will be based on prior knowledge (referenced) for each measurement parameter/method. Quality Assurance samples, replicates, spikes and calibration standards will be used to validate the method in the laboratory. Changes in methods will be reported with reasons and QA results suitable to

support the change, and will include, when appropriate, verification or validation data.

4.2.5 Procedure to Assess Precision and Accuracy

Assessment of precision and accuracy of analytical data is accomplished via review of duplicate analyses (precision) and spike recovery (accuracy) in sample matrices. Precision is generally expressed as the coefficient of variation (CV). Accuracy is expressed as percent recovery. Precision will be assessed for each matrix since distribution of parameters may be non-homogeneous, especially in non-water matrices. Precision in samples will be reviewed with knowledge of the matrix and level of analyte present. Corrective action and documentation of substandard precision is a laboratory responsibility. Accuracy will reflect the impact of matrix interferences. Each method which provides quality control requirements and acceptance criteria also specifies the method of generating the data to be reviewed. It is also the laboratory's responsibility to attempt to identify the source of substandard recoveries and either take corrective action or document the cause. Calculations are presented below:

$$\%R = \frac{\text{observed value}}{\text{theoretical value}} \times 100$$

$$CV = (s/x) \times 100$$

where,

%R = percent recovery;
CV = coefficient of variation;
s = sample standard deviation; and
x = mean value of data set.

Completeness is generally assessed as a percentage of data intended to be generated, and is most often utilized in Phase 3 of the data quality assessment process.

4.2.6 Representativeness of Data

Measurements will be made so that the results are representative of the media and conditions being measured, as possible. Sampling protocols have been developed to assure that samples collected are representative of the media. Sample handling protocols (e.g., storage, transportation) have been selected to protect the representativeness of the collected sample. Proper documentation, e.g., field sampling log notebook, will establish that protocols have been followed and sample identification and integrity assured.

4.2.7 Comparability

The characteristic of comparability reflects both internal consistency of measurements made at the site and expression of results in units consistent with other organizations reporting similar data. Each value reported for a given measurement should be similar to other values within the same data set and within other related data sets. Comparability of data and measuring procedures must also be addressed. This characteristic implies operating within the calibrated range of an instrument and utilizing analytical methodologies which produce comparable results.

Measurements compared to similar measurements which appear as "outliers" (outliers are defined as measurements differing from previous measurements by more than ±3 standard deviation units) will be reassessed. Units of measurement will be externally comparable by utilizing the appropriate standard units for each measurement system.

4.2.8 Quality Assurance Reports

On a predetermined schedule, the QAO will meet with the APM to review QC data summaries, documentation and other aspects of the analytical performance. The assessment of the QA/QC data shall be reported to the Project Manager. This report will highlight any areas that appear to require corrective action, and will also present proposed plans to rectify the apparent problems. Included in this report shall be any results of earlier corrective action that had been initiated.

Quality assurance audits are performed to assure and document that quality control measures are being utilized to provide data of acceptable quality and that subsequent calculations, interpretation and other project outputs are checked and validated.

System and performance audits will be conducted by the QAO. The APM and the QAO will conduct project audits of calculations, interpretations and reports which are based on the measurement system outputs. In addition, personnel from the State or its authorized representatives may obtain access to performance audits.

1.0 Performance Audits: These audits are intended primarily for analytical and data generation systems. This audit will be accomplished by the use of performance evaluation samples. These samples will be randomly submitted by either the APM or QAO during the period when surveys and studies are being carried out for the duration of the program. In addition, audit samples may be submitted by the state.

2.0 System Audit: A systems audit will be conducted on all components of measurement systems to determine proper selection and utilization. The systems audit includes evaluation of both field

and laboratory procedures. Systems audits will be made at regular intervals at each laboratory used and whenever a new analysis is initiated. The results of the systems audit will be reported in an appropriate QA report.

3.0 Organization and Personnel: The QA Plan organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be evaluated to determine that assigned responsibility, skill and training of the personnel are properly matched. The APM maintains firsthand knowledge of his team's capabilities and will discuss the organization's efficiency with the QAO. Assigned personnel may be interviewed by the QAO during an audit.

4.0 Facilities and Equipment: The audit will address whether field tools and analytical instruments are selected and used to meet requirements specified by the QA Plan objectives. Equipment and facilities provided for personnel health and safety will also be evaluated. Calibration and documentation procedures for instruments used in the field will receive special attention.

5.0 Analytical Methodology: A review of analytical methodology in regard to the data requirements for the QA Plan will be performed. An onsite observation of analyst technique, data reduction and recordkeeping may be performed if determined necessary. A review of precision and accuracy data will be performed for each batch of samples.

6.0 Sampling and Sample Handling Procedure: An audit of scheduled samples versus samples collected versus samples received for analysis will be performed. Field documentation will be reviewed. If deemed necessary, field or laboratory visits will be made to assure that designated control procedures are practiced during sampling activities.

7.0 Data Handling: During a systems audit, the QAO will review data handling procedures with the APM. Accuracy, consistency and documentation will be discussed.

8.0 QA Plan Audit: QA Plan audits encompass the aspects of both the systems audit and the performance audit. The QA Plan audit typically occurs once but may occur more often if required. Timing is keyed to the systems involved and the QA Plan objectives.

9.0 QA Plan Audit Report: A written QA Plan Audit Report will be prepared for each QA Plan Audit and will include:

- an assessment of QA Plan team status in each of the major QA Plan areas;
- clear statements of areas requiring improvement or problems to be corrected. Recommendation and assistance will be provided regarding proposed corrective actions or system improvements. If no action is required, the report will state that the QA Plan audit was satisfactorily completed;
- a timetable for any corrective action required; and
- a follow-up to assure that recommendations have been implemented.

The format for the Quality Assurance Plan Audit is found below. The QA Plan Audit Report will be distributed to the APM and the Project Coordinator.

QUALITY ASSURANCE PLAN AUDIT REPORT FORM
(Topics for inclusion in report)

Organization and Personnel
Facilities Utilized
Analytical Methodologies
Sampling and Sample Handling
Quality Control Measures Utilized
Data Handling
Quality Assurance Deficiencies
Recommended Corrective Actions and Schedule

4.3 Sampling Methodology

Refer to Appendices K and F for soil and water sampling methodology.

4.3.1 Non-Aqueous Phase Liquids (NAPL)

In the event that immiscible layers are present, the following special sampling procedures will be considered. Well development and purge water from all wells will be passed through a container and visually inspected for the presence of NAPL. Evidence of NAPL will be recorded and a sample will be taken if practical. During sampling, the first volume of water from each well will be placed directly into vials used for volatile organic analysis and visually inspected for NAPL. If NAPL is present as a discernible second phase or globules, it will be collected separately. If only a sheen is present, it will not be collected separately. The NAPL will immediately be placed in a glass septum capped "volatiles" container of an appropriate size to minimize head space.

4.4 Field Operation Documentation

4.4.1 Sampling Locations

All sampling locations will be surveyed from permanent reference points. Both vertical elevations and surface map coordinates will be determined for each sample location. These locations will be submitted in tabular format and scaled graphic map presentation.

4.4.2 Field Measurements

An integral part of field quality control is the documentation of all aspects of sample collection. Records are maintained as a routine part of quality assurance, including a field notebook, chain-of-custody forms/ procedure, and a field equipment calibration notebook. Field notebooks are used to record pertinent observations (e.g., odors, visual matters of interest, weather), field measurements (e.g., water levels, pH, specific conductance), and any irregularities or deviations from the prescribed sampling procedure. All entries are initialled for personnel identification. All notebooks are to be weatherproof and entries made with waterproof ink. The following items will be documented in the field book for sample collection work performed at the OCC Hooker/Ruco site during this specific investigation:

- identification of well;
- static water-level depth and measurement technique;
- well yield - high or low;
- purge volume and pumping rate;
- time well purged;
- presence of NAPL and detection method;
- collection method for NAPL and sample ID numbers;
- well evacuation procedure/equipment;
- date and time of collection;
- well sampling sequence;

- types of sample containers used and sample ID numbers;
- preservative(s) used;
- parameters requested for analysis;
- field analysis data and method(s);
- field observation on sampling event;
- name of collector;
- climatic conditions including air temperature.

Ground-water measurements will be made in the field for pH and specific conductance. Calibration and standardization will be performed as stated in Appendices D and E. The pH meter will be fully calibrated at least two times daily and will be checked with pH 7 buffer every ten samples, two hours, or every time it has been turned off for more than two hours and then turned on, whichever occurs first. The specific conductance meter will be calibrated at the beginning and in the middle of the work day.

4.4.3 Instrument Logs

Calibration and standardization of field instruments are recorded in dedicated log books to document this data and determine accuracy and precision parameters, as well as track calibration, maintenance and repair history. All entries are initialled or personnel identification.

4.4.4 Field Reagents

No reagents or supplies used in the field, except EPA approved preservatives supplied in the laboratory sample containers by the approved laboratory, will become an integral part of any sample. All samples will be analyzed as total matrix samples; thus no filtering, adsorption, centrifugation or any field preparation technique, aside from pumping to the bottle, will be performed. OCC may, at its option take additional filtered samples for metals analysis. The appropriate parameter specific containers,

preservation and maximum allowable holding times are presented in Appendix G.

4.4.5 Field Duplicates, Blanks

To effectively monitor the potential for data inconsistencies from laboratory or field handling procedures, duplicate sampling and analysis will be conducted for all matrices and will also provide combined sampling and analytical precision data. Field or equipment blanks will be obtained during this investigation. One field blank will be obtained for each type of sampling equipment used each day. For example, one split spoon quality control sample, obtained on a cleaned sampler, will be obtained during each day of subsurface soil sampling. Other equipment will include pans and spatulas used for sampling homogenization, and ground-water sampling equipment.

Trip blanks, consisting of demonstrated analyte-free water and sealed in appropriate 40 ml septum vials, will be transported into the field where sampling for volatile organics in an aqueous matrix occurs. Trip blank samples will be collected at a frequency of one per day. Split samples will be made available to EPA upon request.

Duplicate samples will be taken for soil samples at the rate of 10 percent. The duplicate samples will be chosen from various borings to provide samples representing different depths of boring, different areas of the site, and any differences based on visual or HNU screening. All duplicates will be blind-coded.

Duplicate samples will be collected for ground-water samples at the rate of 10 percent and will be blind-coded.

4.4.6 Containers

Three hundred series containers will be obtained from I-Chem Research, Hayward, California, or performance equivalent. All sample container caps and septa for organic

analysis will be Teflon lined. Polyethylene caps will be used on sample containers for inorganic analyses.

4.5 Sample Analysis

4.5.1 Chain-of-Custody

The designated Contract Laboratory, Radian Corporation, will provide sample chain-of-custody as prescribed in the USEPA CLP Statement of Work for Organic Analyses, 2/88 and for Inorganic Analysis, 12/87. At the minimum the record will contain the following types of information:

- sample number;
- signature of collector;
- date and time of collection;
- sample type (e.g., ground water, NAPL);
- identification of well;
- number of containers;
- parameters requested for analysis;
- signature of person(s) involved in the chain of possession; and
- inclusive dates of possession.

To prevent misidentification of samples, legible labels will be affixed to each sample container. The labels will be

sufficiently waterproof and durable to remain legible even when wet and will contain the following information:

- sample identification number;
- name of collector:
- date and time of collection;
- place of collection; and
- parameter(s) requested (if space permits).

In cases where samples may leave the site project coordinator's immediate control, such as shipment to laboratory by a common carrier, a seal will be provided on the shipping container or individual sample bottles to ensure that the samples have not been disturbed during transportation. See figure 10 for an example of a chain-of-custody form.

4.5.2 Sample Storage Procedures and Holding Times

Sample preservation techniques and holding times are in Appendix G. Sample size, preservation, storage and holding times are addressed in USEPA-CLP SOW of Organic Analysis, 2/88 and for Inorganic Analysis, 12/87; in EPA 524.2; and in table 1 of Appendix M.

The preservation procedure for volatile organics is as follows:

Adjust the pH of the sample to less than 2 by carefully adding 1:1 HCl drop by drop to the required two (2) 40-ml VOA sample vials. The number of drops of 1:1 HCl required should be determined on a third portion of sample water of equal volume. Cool to 4°C.

If acidification of the sample causes effervescence, the sample should be submitted without preservation except for cooling to 4°C. This sample property should be appropriately noted when present.

4.5.3 Sample Preparation Methods

Sample preparation for aqueous and soil semi-volatile TCL constituents and volatile soil TCL constituents is addressed in USEPA-CLP Statement of Work (SOW) for "Organic Analyses, Multi-Media, Multi-Concentration" 2/88; sample preparation for aqueous volatile constituents is addressed in EPA Method 524.2, August 1986.

USEPA-CLP Statement of Work (SOW) for "Inorganic Analyses, Multi-Media, Multi-Concentration" 12/87, will be used in sample preparation for aqueous and soil inorganic TCL constituents.

4.5.4 Analytical Procedures

USEPA-CLP Statement of Work (SOW) for "Organic Analyses, Multi-Media, Multi-Concentration" 2/88, will be used in the analysis of water and soil for semi-volatile TCL constituents and soil for volatile TCL constituents; analysis of water for volatile constituents is addressed in EPA Method 524.2, August 1986.

USEPA-CLP Statement of Work (SOW) for "Inorganic Analyses, Multi-Media, Multi-Concentration" 12/87, will be used in the analysis of water and soil for inorganic TCL constituents.

4.5.5 Calibration Procedures and Frequency

All calibration procedures and their frequency shall be followed as described in CLP SOW Inorganics, 12/87 and Organics, 2/88, and at a minimum will include the following. All standards used for quantitation must be traceable to an EPA EMSL standard whenever possible, and if not, to a verified standard. This is a compound whose purity has been determined by at least two different analytical procedures. Linearity of detector response for each parameter must be demonstrated by generation of a linearity curve containing five concentrations of that parameter. All sample calculations must be made from responses which fall within this

linearity range. During the course of the analysis, standards must be interspersed at frequent intervals to check the calibration. The preparation of all standards, including purity verification, dilutions, linearities, etc., must be recorded in a bound notebook with each page or work unit signed and dated by the analyst.

4.5.6 Data Reduction, Validation and Reporting

All raw data will be examined, evaluated and then reduced to final results. The final results will be expressed in units of measurement that permit comparison with data generated from similar projects and analyses performed pursuant to the investigation at this facility.

All raw data shall be reviewed and validated against calibration and QC records to ensure that data are reliable, and that the data are in compliance with the QA/QC objectives. Any data determined to be invalid shall not be used in the RI Report but will be made available to EPA upon request. However, the fact that data have been invalidated and the reasons for the invalidation will be reported. All valid data shall be reported in the following order:

1. Analytical Program Manager;
2. Site Coordinator; and
3. EPA.

The report format will include at least the following:

- sample ID number or code;
- place of collection;
- date sampled; and
- date analyzed.

4.5.7 Internal Quality Control Checks, Laboratory Performance and Systems Audits and Frequency

The QC checks described below will be used to assess the quality of both the sampling procedures and of the sample analyses used for this project.

1. Method Blank(s): Method blanks are to be prepared in the laboratory and analyzed to assess possible laboratory contamination.
2. Laboratory Control Samples (Method Spikes): Method spikes (blank spikes) will be prepared and analyzed. Reagent grade water is spiked with one or more selected compounds prior to extraction. The recovery of the compound(s) is used as a measure of the accuracy of the sample preparation and analysis procedures. At least ten percent of the total number of samples analyzed will also be method spike samples.
3. Calibration Check Sample(s): During the course of analysis, every twentieth sample shall be a calibration check standard. This standard shall be prepared from a "second source", that is, a supplier(s) different from the primary calibration standard. The purpose of this calibration check is to ensure the validity of the calibration standard.
4. Replicate Sample(s): These samples are analyzed in order to establish control and assess the precision of analysis and/or of sampling. At least ten percent of the total number of samples to be analyzed will be replicated.
5. Matrix-Spiked Sample(s): Matrix-spiked samples are from site(s) sampled in duplicate. This sample is spiked with one or more selected compounds prior to extraction. The recovery of the compound(s) is used as a measure of the accuracy of the sample preparation and analysis procedures. At least ten percent of the total number of samples analyzed will also be spiked samples.
6. Blind Quality Control Samples: If deemed necessary, these will be submitted by the QAO.

7. Control Charts: Precision and accuracy will be monitored by use of control charts. Accuracy will be expressed in terms of percent recovery. A minimum of twenty data points are needed to construct the percent recovery control chart. The details of control charting are beyond the scope of this document, but at a minimum will include the following:
   - the average (mean) recovery of twenty analyses (X);
   - the standard deviation of the mean (SD);
   - an upper and lower warning limit, which is the mean plus or minus two standard deviation units (X ± 2xSD); and
   - an upper and lower control limit, which is the mean plus or minus three standard deviation units (X ± 3xSD).

   Percent recoveries will then be plotted on the control chart to determine whether or not they are acceptable.
8. Surrogate Compounds: Surrogate compounds will be used to determine extraction efficiency and analytical accuracy as described in USEPA CLP Statement of Work for Inorganic, 12/87 and Organic Analyses, 2/88.
9. Zero and Span Gases: Zero and span gases will be purchased from commercial suppliers and used as is.
10. Reagent Quality Control Checks: Reagent and solvent blanks are prepared in the laboratory and analyzed to determine background of reagents and solvents used in the routine analysis.

4.5.8 Preventative Maintenance Procedures and Schedules

Major instrument maintenance will be that as suggested by the instrument manufacturer. However, maintenance such

as column replacement, detector and source cleaning, filament replacement, etc., is to be performed as needed when either instrument performance declines or QC check criteria are not achieved.

4.5.9 Laboratory Corrective Action

Corrective action will be taken when conditions are identified that are adversely affecting data quality or exhibit potential to adversely affect data quality. The corrective action taken may be immediate, as in repairing an instrument malfunction, or may be long-term plan of action in order to eliminate recurring problems. Corrective action may be initiated as the result of instrument problems. Corrective action may include, but is not limited to the following:

- reclamation of instruments with fresh standards;
- replacement of solvents and/or reagents that yield unacceptable blank values; or
- additional training and/or reassignment of personnel.

4.5.10 Turnaround Time

Samples will be sent to the laboratory within 24 hours of being obtained. The normal turnaround period under CLP is 40 days.

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TABLES

TABLE 1

SAMPLE SUMMARY OF
HOOKER/RUCO PHASE 1 PROGRAM

Type	Number of locations	Samples per location		Total samples		Total sample air
		soil	water	soil[1]	water[1]	
Shallow Wells (100 feet)						
Existing onsite[4]	6	--	1	--	6	
Existing offsite	5	--	1	--	5	
New[4]	14	3[b]	1	18	14	
Deep Wells (greater than 100 feet)						
Existing onsite[4]	6	--	1	--	6	
New[4]	8	3[c]	1	24	8	
Surface Water (Sumps)	3	--	1	--	3	
Water Levels						
New Shallow Piezometers	2					
Existing Shallow Piezometers	2					
Deep (from above wells)	14					
Shallow (from above wells)	25					
Soil Borings						
Sumps[3]	13	3[a]	--	39	--	
Tank Areas	9	2	--	18	--	
Drum Pad Area	8	2	--	16	--	
Old Drum Storage Area	4	2	--	8	--	
Pilot Plant, PCB Spill	5	2	--	10	--	
Sump 1, Old Drainage Line	1	2	--	2	--	
Ambient Air[5]						
Pilot Plant, PCB Spill						8
TOTAL[2]				135	42	8

1/ All samples to be analyzed for all TCL Parameters plus tentatively identified compounds. Soils will also be tested for MOCA. Water will be field tested for pH, specific conductance and temperature.
2/ Does not include blanks, or duplicates.
3/ Two soil samples from each sump (total of 12 samples) will also be tested for organic content, moisture content and cation exchange capacity.
4/ Water samples for shallow and deep wells at GW-1, GW-3 and GW-11 will also be tested for BOD, TOC, oil and grease, alkalinity, TSS, TDS, hardness, chloride, sulfate and COD
5/ Air samples will be analyzed for TCL volatile organics, PCB's and particulates.

a/ Three in minimum number of samples. Up to 5 samples per location may be taken in Sumps 1, 5 and 6.
b/ Soil samples will be taken at 6 shallow well locations. Additional samples may be taken based on contamination observed in the field.
c/ Additional samples may be taken based on contamination observed in the field.

TABLE 2

WATER QUALITY CONTAMINANT-SPECIFIC REQUIREMENTS (ARARs)

CHEMICAL	SAFE DRINKING WATER ACT AND NYS[f] MCLs (mg/l)	CLEAN WATER ACT Water Quality Criteria for Human Health — Adjusted for Drinking Water Only a/	SAFE DRINKING WATER ACT Health Advisories (mg/l) 1-Day	10-Day	Longer Term	NEW YORK STATE CLASS GA GROUNDWATER STANDARDS Criteria in Milligrams per Liter Unless Otherwise Specified
Acenaphthene		20 ug/l (Organoleptic)[b/]				
Aldrin		0 (1.2 ng/l)				ND
Antimony		146 ug/l				
Arsenic	0.05	(25 ng/l)				0.025
Barium	1.0					1.0
Benzene	0.005[f/]	0 (0.67 ug/l)		0.23	0.07	ND
Beryllium		0 (3.9 ng/l)				
Cadmium	0.01	10 ug/l				0.01
Carbon tetrachloride	0.005[f/]	0 (0.42 ug/l)	0.2	0.02		5 ug/l
Chlordane		0 (22 ng/l)	0.0625	0.0625	0.0075	0.1 ug/l
1,2-Dichloroethane	0.005[f/]	0 (0.94 ug/l)	Insufficient Data			
1,1,1-Trichloroethane	0.005[f/]	19 mg/l			1.0	
1,1,2-Trichloroethane		0 (0.6 ug/l)				
1,1,2,2-Tetrachloroethane		0 (0.17 ug/l)				
Monochloroethane		Insufficient data				
1,1-Dichloroethane		Insufficient data				
1,1,1,2-Tetrachloroethane		Insufficient data				
2,6-Dichlorophenol		0.2 ug/l (Organoleptic)				
2,4,5-Trichlorophenol		2600 ug/l				
2,4,6-Trichlorophenol		0 (1.8 ug/l)				
3-Methyl-4-chlorophenol		3000 ug/l (Organoleptic)				
bis-(2-Chloroethyl) ether		0 (30 ng/l)				1.0 ug/l
bis-(2-Chloroisopropyl) ether		34.7 ug/l				
Chloroform	0.1[d/]	0 (0.19 ug/l)				100 ug/l
2-Chlorophenol		0.1 ug/l (Organoleptic)				
Chlorophenoxys	0.01-.1					
Chromium Cr^{+6}	0.005[f]	50 ug/l				0.05
Copper		170 mg/l				1.0
DDT		0 (1.2 ng/l)				ND
Dichlorobenzenes (all isomers)	0.005[f/]	470 ug/l				4.7 ug/ml
Dichlorobenzidines		0 (20.7 ng/l)				

TABLE 2
(continued)

WATER QUALITY CONTAMINANT-SPECIFIC REQUIREMENTS (ARARs)

CHEMICAL	SAFE DRINKING WATER ACT AND NYS[f] MCLs (mg/l)	CLEAN WATER ACT Water Quality Criteria for Human Health — Adjusted for Drinking Water Only a/	SAFE DRINKING WATER ACT Health Advisories (mg/l) 1-Day	10-Day	Longer Term	NEW YORK STATE CLASS GA GROUNDWATER STANDARDS Criteria in Milligrams per Liter Unless Otherwise Specified
Dichloromethane		See Halomethanes	13	1.3	0.15	
2,4-Dichlorophenol		3.09 mg/l				
Dichloropropanes	0.005[f/]	Insufficient Data				
Dichloropropenes	0.005[f/]	87 ug/l				
Dieldrin		0 (1.1 ng/l)				ND
2,4-Dimethylphenol		400 ug/l (Organoleptic)				
2,4-Dinitrotoluene		0 (0.11 ug/l)				
Endosulfan		138 ug/l				
Endrin	0.0002	1 ug/l				ND
Ethylbenzene	0.005[f/]	2.4 mg/l				
Fluoranthene		188 ug/l				1.5
Fluoride	1.4-2.4					
Halomethanes		0 (0.19 ug/l)				
Heptachlor		0 (11 ng/l)				ND
Hexachlorobutadiene	0.005[f/]	0 (0.45 ug/l)				
Lindane (99% gamma-HCH)	0.004					ND
Hexachlorocyclopentadiene		206 ug/l				
Isophorone		5.2 mg/l				
Lead	0.05	50 ug/l				0.025
Mercury	0.002	10 ug/l				0.002
Methoxychlor	0.05[f/]					35.0 ug/l
Methyl Ethyl Ketone			7.5	0.750		
Naphthalene		Insufficient Data				
Nickel		15.4 ug/l				
Nitrobenzene		19.8 mg/l				
Dinitrophenol		70 ug/l				
Mononitrophenol		Insufficient Data				
n-Nitrosodiphenylamine		0 (7.0 ug/l)				
Pentachlorophenol		1.01 mg/l				21 ug/l
Phenol		3.5 mg/l				0.001
Dimethylphthalate		350 mg/l				
Diethylphthalate		434 mg/l				
Dibutylphthalate		44 mg/l				770 ug/l
Di-2-ethylhexylphthalate		21 mg/l				
Polychlorinated biphenyls (PCBs)		0 (12.6 ng/l)	0.125	0.0125		0.1 ug/l
Polynuclear aromatic hydrocarbons (PAHs)		0 (3.1 ng/l)				

TABLE 2
(continued)

WATER QUALITY CONTAMINANT-SPECIFIC REQUIREMENTS (ARARs)

CHEMICAL	SAFE DRINKING WATER ACT AND NYS[f] MCLs (mg/l)	CLEAN WATER ACT Water Quality Criteria for Human Health — Adjusted for Drinking Water Only a/	SAFE DRINKING WATER ACT Health Advisories (mg/l) 1-Day	10-Day	Longer Term	NEW YORK STATE CLASS GA GROUNDWATER STANDARDS Criteria in Milligrams per Liter Unless Otherwise Specified
Selenium	0.01	10 ug/l				0.02
Silver	0.05	50 ug/l				0.05
Sulfate						250
Styrene	0.005[f/]					931 ug/l
Tetrachloroethylene	0.005	0 (0.88 ug/l)	2.3	0.175	0.02	
Thallium		17.8 ug/l				
Toluene	0.005[f/]	15 mg/l	21.5	2.2	0.34	
Trichloroethylene	0.005[f/]	0 (2.8 ug/l)	2.0	0.2	0.075	0.010
Trihalomethanes (total)[e/]	0.1					
Vinyl chloride	0.002[f/]	0 (2.0 ug/l)				5.0 ug/l
Xylenes	0.005[f/]		12	1.2	0.62	
Zinc		5 mg/l (organoleptic)				5

a/ These adjusted criteria, for drinking water ingestion only, were derived from published EPA Water Quality Criteria (Federal Register 45:79318-79379, November 28, 1980) for combined fish and drinking water ingestion and for fish ingestion alone. The adjusted values are not official EPA Water Quality Criteria, but may be appropriate for Superfund sites with contaminated ground water. In the derivation of these values intake was assumed to be 2 liters/day for drinking water and 6.5 grams/day for fish, and human body weight was assumed to be 60 kilograms. Values for bioconcentration factor carcinogenic potency, and acceptable daily intake were those used for water quality criteria development.

b/ Criteria designated as organoleptic are based on taste and odor effects, not human health effects. Health-based Water Quality Criteria are not available for these chemicals.

c/ The criterion for all carcinogens is zero; the concentration given in parentheses corresponds to a carcinogenic risk of 10^{-6}. Water quality criteria documents present concentrations resulting in carcinogenic risks of 10^{-5} to 10^{-7}. To obtain concentrations corresponding to risks at 10^{-4} and 10^{-5}, the 10^{-6} concentration should be multiplied by 100 and 10, respectively. To obtain concentrations corresponding to risks of 10^{-7} and 10^{-8}, the 10^{-6} concentration should be divided by 10 and 100, respectively.

d/ Chloroform is one of four trihalomethanes whose sum concentration must be less than 0.1 mg/l.

e/ Total trihalomethanes refers to the sum concentration of chloroform, bromodichloromethane, dibromo-chloromethane, and bromoform.

f/ Proposed NYS MCLs are provided where they are more stringent than existing SDWA MCLs. In addition to specific levels shown, all principal organic contaminants have a proposed MCL of 0.005 mg/l.

ND Not Detectable

MCL Maximum Contaminant Level

* Compounds that are suspected contaminants

TABLE 3

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

September 1985

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Chemical Name, Formula, CAS, RTECS, and DOT UN or NA and Guide Numbers	Synonyms	Exposure Limits	IDLH Level	Physical Description	Chemical and Physical Properties		Incompatibilities	Measurement Method (See Tables 1a and 1b)
Tetrachloroethylene CCl_2CCl_2 127-18-4 KX3850000 1897 74	Perchloroethylene, Perchlorethylene, Tetrachloroethylene, Perc	100 ppm 200 ppm ceil 300 ppm/ 5 min/3-hr peak (NIOSH) Lowest feasible level See Appendix A (ACGIH) 50 ppm	500 ppm Ca	Colorless liquid with an odor like ether or chloroform	MW: 166 BP: 250°F Sol: 0.015% Not combustible IP: 9.32 eV	VP: 14 mm MP: 6°F	Strong oxidizers, chemically active metals, such as barium, lithium, beryllium	Char; CS; GC; J
1,2-Dichloroethylene $ClCH{=}CHCl$ 540-59-0 KV9360000 1150 20	Acetylene dichloride, cis-Acetylene dichloride, Dichloroethylene, trans-Acetylene dichloride, sym-Dichloroethylene	200 ppm (790 mg/m³)	4000 ppm	Colorless liquid with an ether-like, slightly acrid odor, like chloroform	MW: 97 BP: 113 to 148°F Sol: 0.35 to 0.63% Fl P: 35 to 39°F IP: 9.65 eV	VP: 180 to 395 mm MP: -56 to 115°F UEL: 12.8% LEL: 9.7%	Strong oxidizers	Char; CS; GC; IR
Trichloroethylene $ClHC{=}CCl_2$ 79-01-6 KJ4550000 1710 74	Ethylene trichloride, Trilene	100 ppm 200 ppm ceil 300 ppm peak (NIOSH) 25 ppm 10-hr TWA See Appendix A (ACGIH) 50 ppm	1000 ppm Ca	Colorless liquid, unless dyed, with a sweet odor like chloroform	MW: 131 BP: 188°F Sol: 0.1% Fl P: None IP: 9.47 eV	VP: 58 mm MP: -123°F UEL: 41% LEL: 11%	Strong caustics; when acidic reacts with aluminum; chemically active metals, barium, lithium, sodium, magnesium, titanium	Char; CS; GC; J
Vinyl chloride C_2H_3Cl 75-01-4 KU9625000 1086 17	Chloroethylene, Chloroethene, Monochloroethylene, Ethylene monochloride, Monochloroethene, Vinyl C monomer Trondur, VC, Vinyl chloride monomer, VCM	1 ppm 5 ppm 15-min ceil (NIOSH) Lowest detectable limit See Appendix A (ACGIH) 5 ppm, A1a	Ca	Colorless gas; liquefies in a freezing mixture	MW: 62.5 BP: 7°F Sol: Slight Fl P: -108°F IP: 9.995 eV	VP: 2580 mm MP: -245°F UEL: 33 LEL: 3.6	Copper oxidizing materials	NIOSH 77-157A

Personal Protection and Sanitation (See Table 2)	Respirator Selection Upper Limit Devices Recommended (See Table 3)	Health Hazards: Route	Symptoms (See Table 4)	First Aid (See Table 5)		Target Organs
Clothing: Repeat prolong Goggles: Reason prob Wash: Promptly upon contam Change: N A Remove: Promptly contam non-imperv	NIOSH E SCBAF PD PPI SAF PD,PP ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Irrit eyes, nose, throat; nau, flush face, neck; vertigo, dizz, incoh, nosd; asm, eryt, [carc]	Eye: Skin: Breath: Swallow:	Irr immed Soap + wash promptly Art resp Medical attention immed	Liver, kidneys, eyes, upper resp sys, CNS
Clothing: Repeat prolong Goggles: Reason prob Wash: Promptly upon wet Change: N A Remove: Any wet immed (Remov)	OSHA 1000 ppm: PAPROV+CCRPOV 4000 ppm: SA:CF+GMFOV/SCBAF/SAF D: SCBAF PD PPI SAF PD PP ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Irrit eyes, resp sys; CNS depression	Eye: Skin: Breath: Swallow:	Irr immed Soap wash promptly Art resp Medical attention immed	Resp sys, eyes, CNS
Clothing: Repeat prolong Goggles: Reason prob Wash: Promptly upon wet Change: N A Remove: Promptly wet non-imperv	NIOSH E SCBAF PD PPI SAF PD PP ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Head, vertigo, vis dist, tremors, somnolence, nau, vomit, irrit eyes, derm; card arrhy; paresi; [carc]	Eye: Skin: Breath: Swallow:	Irr immed Soap wash promptly Art resp Medical attention immed	Resp sys, heart, liver, kidneys, CNS, skin
Clothing: Any poss Goggles: Any poss Wash: Immed upon contamination Change: After work if any poss contam Remove: Any contam immed Provide: Eyewash, quick drench	NIOSH E SCBAF PD PPI SAF PD,PP ASCBA Escape: GMFS/SCBAE	Inh	Weak, abdom pain, GI bleeding, hematomegaly, pal or cyan of extrem, [carc]	Breath	Art resp	Liver, CNS, blood, resp sys, lymphatic sys

FIGURES

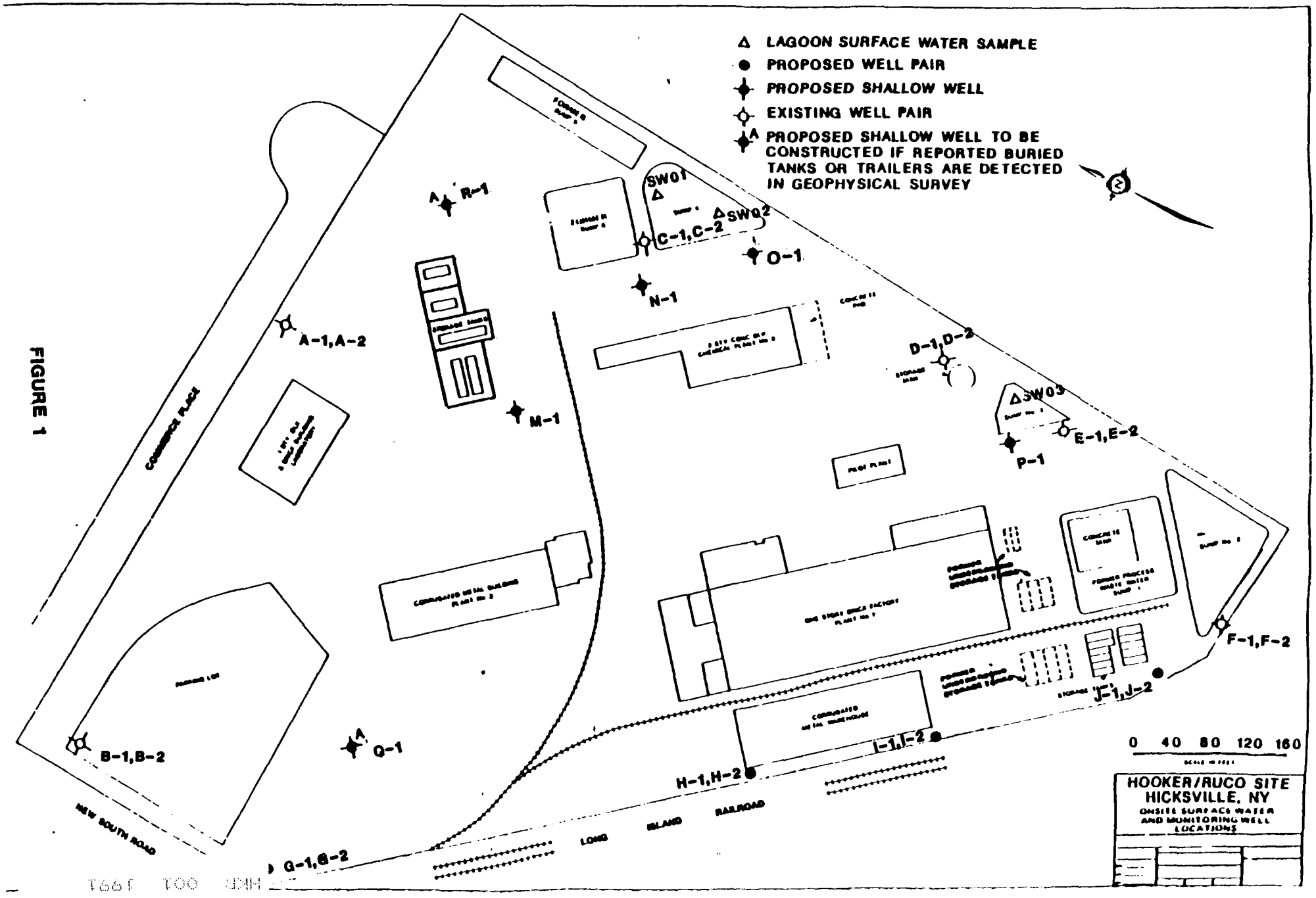
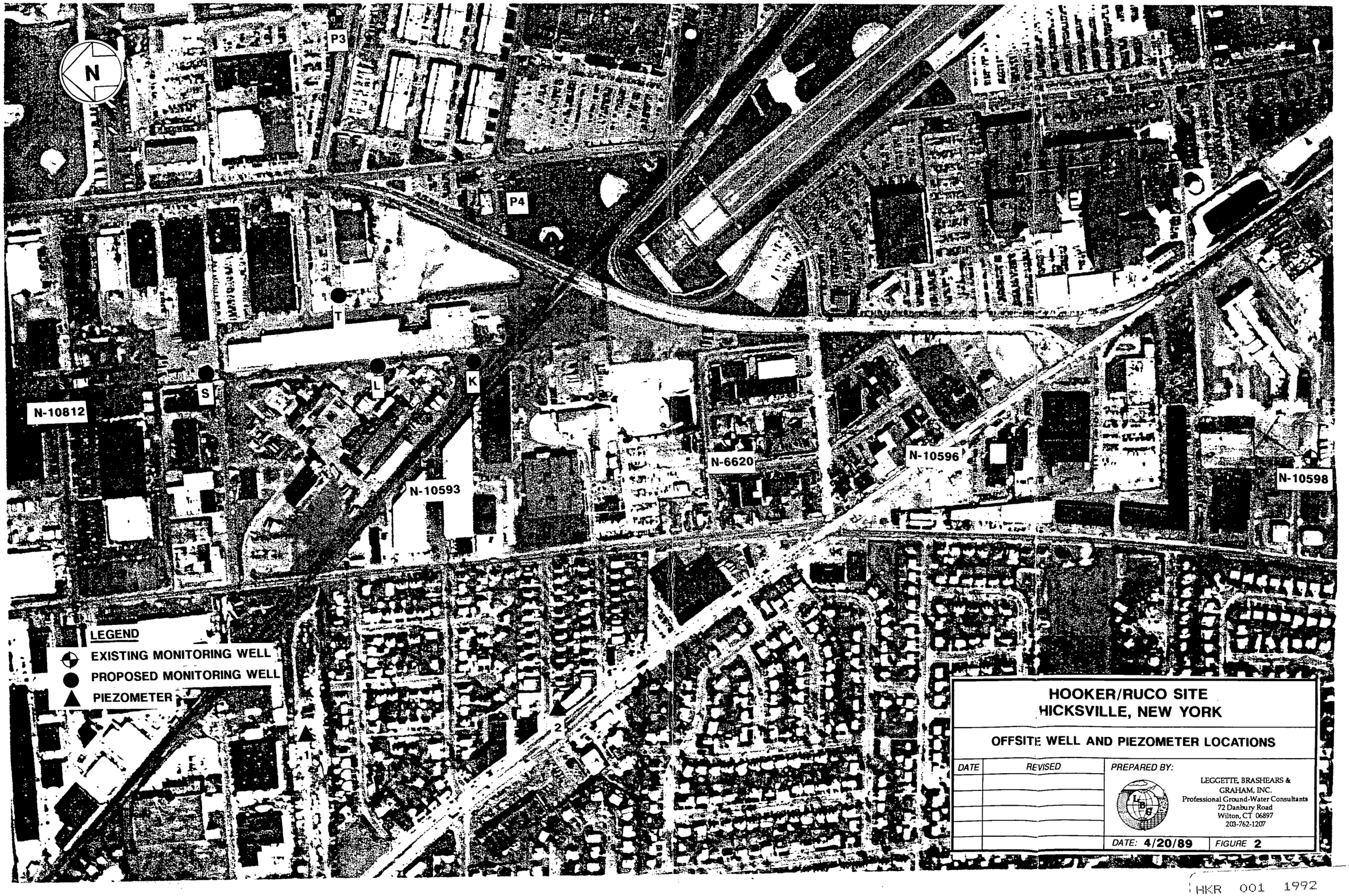

LAGOON SURFACE WATER SAMPLE
PROPOSED WELL PAIR
PROPOSED SHALLOW WELL
EXISTING WELL PAIR
PROPOSED SHALLOW WELL TO BE CONSTRUCTED IF REPORTED BURIED TANKS OR TRAILERS ARE DETECTED IN GEOPHYSICAL SURVEY
SW01
SW02
SW03
R-1
C-1,C-2
O-1
N-1
A-1,A-2
M-1
D-1,D-2
E-1,E-2
P-1
F-1,F-2
J-1,J-2
I-1,I-2
H-1,H-2
Q-1
B-1,B-2
G-1,G-2
COMMERCE PLACE
NEW SOUTH ROAD
LONG ISLAND RAILROAD
0 40 80 120 160
HOOKER/RUCO SITE
HICKSVILLE, NY
ONSITE SURFACE WATER AND MONITORING WELL LOCATIONS

FIGURE 1



HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

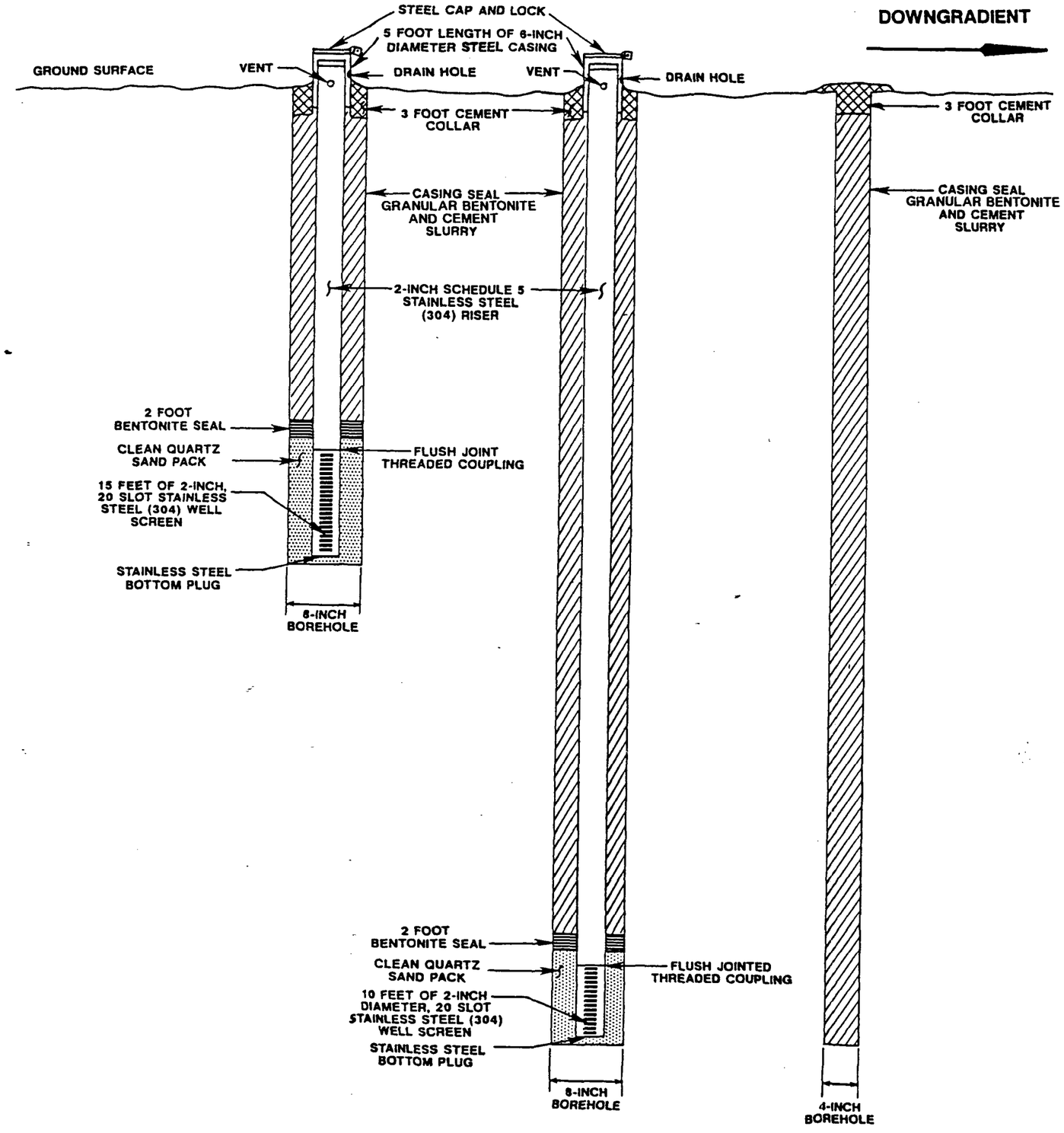
OFFSITE WELL AND PIEZOMETER LOCATIONS

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
203-762-1207

DATE: 4/20/89 FIGURE 2



OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

TYPICAL GROUND-WATER CLUSTER WELL CONSTRUCTION

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
203-762-1207

DATE: 3/30/89 FIGURE 3

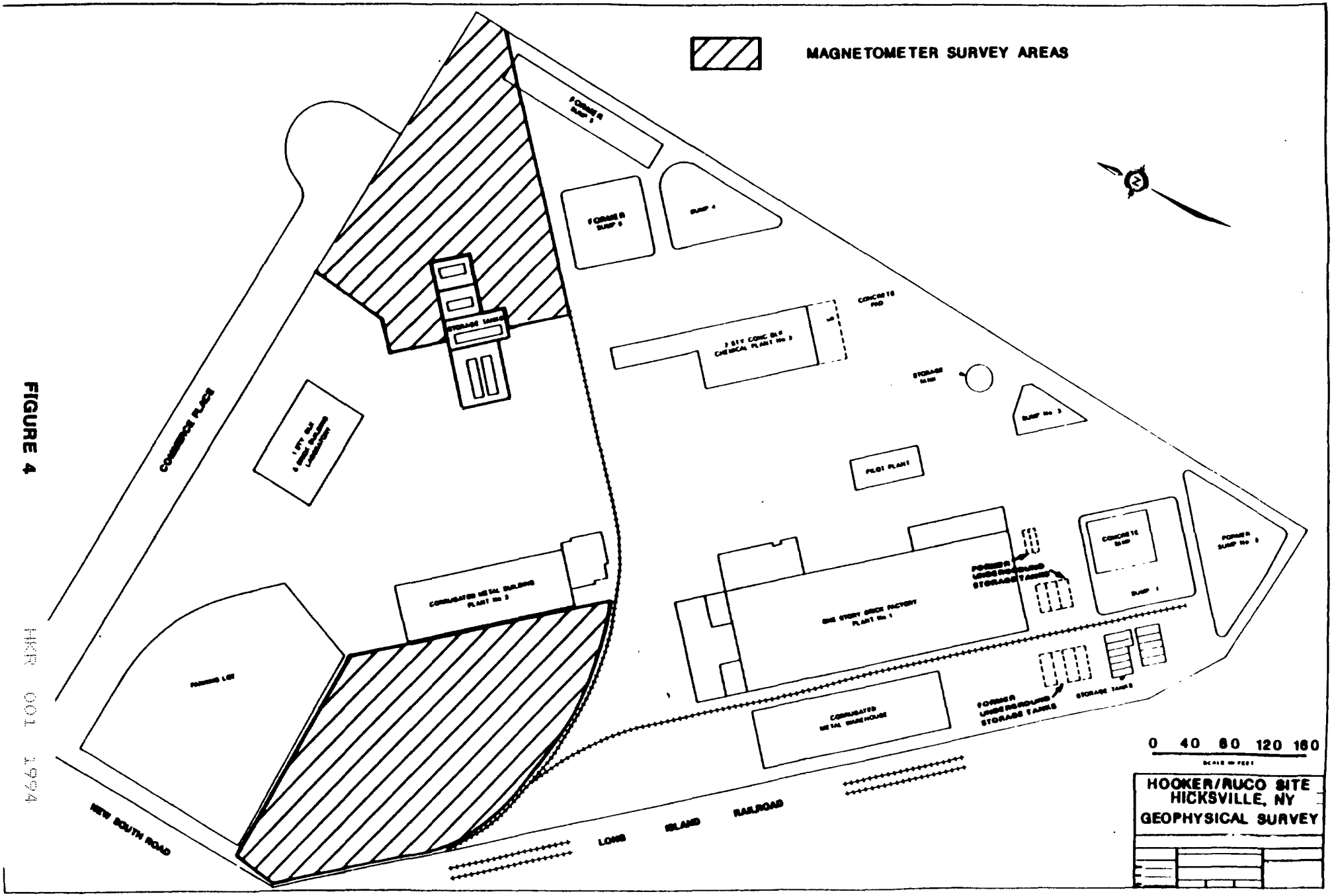
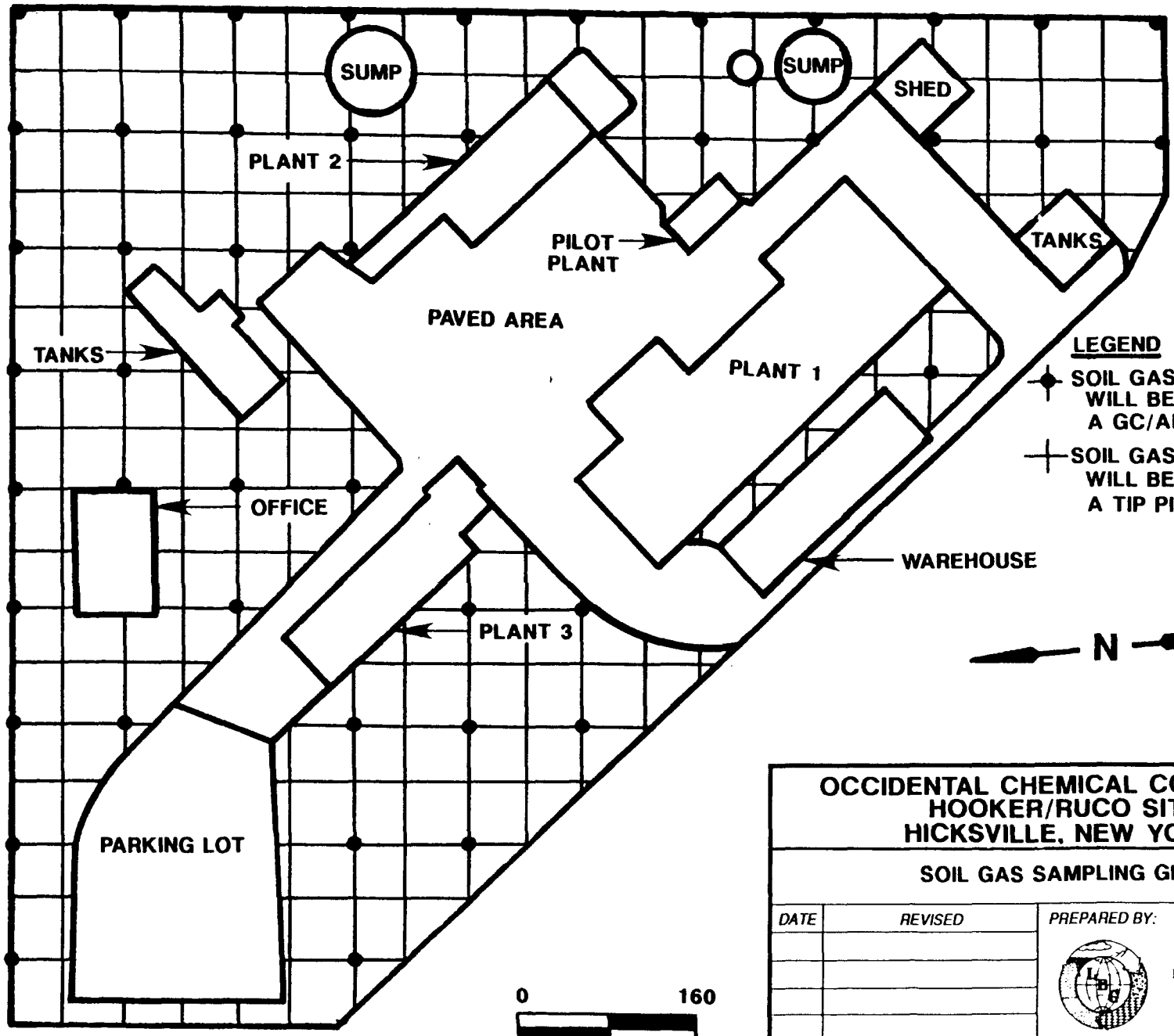


FIGURE 4



HKR 001 1995

OCCIDENTAL CHEMICAL CORPORATION
HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

SOIL GAS SAMPLING GRID

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
203-762-1207

DATE: 4/5/89

FIGURE 5

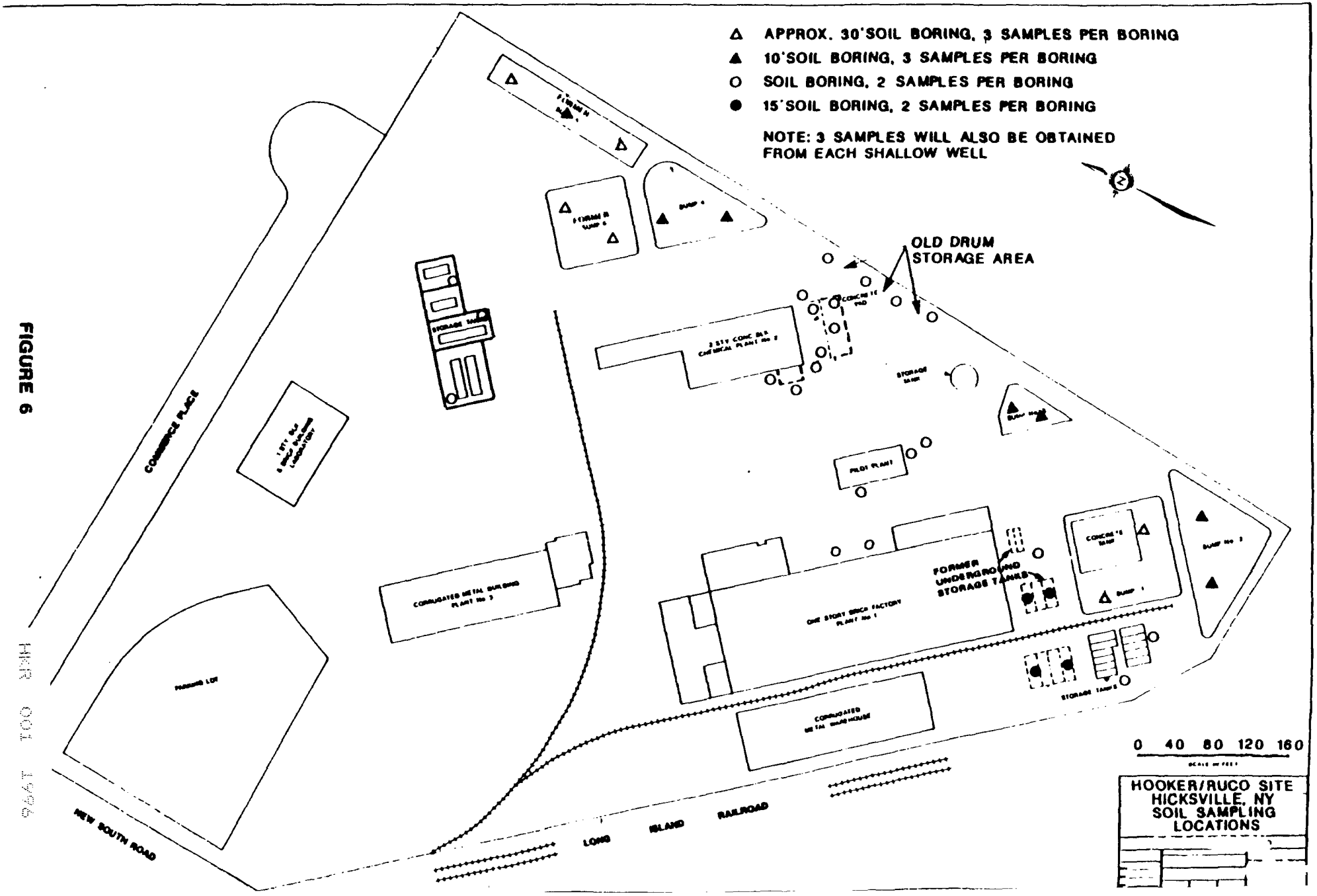


FIGURE 6

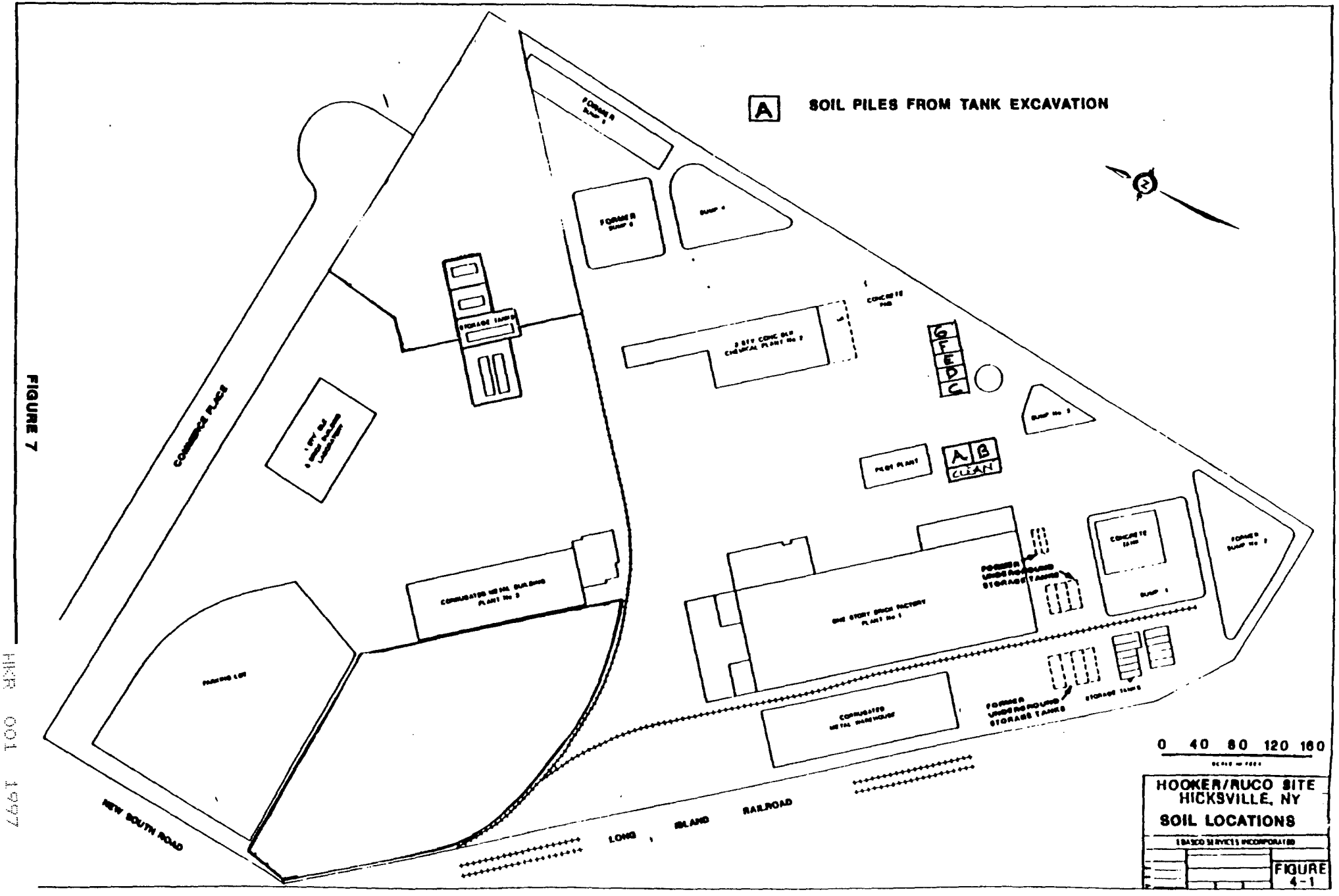
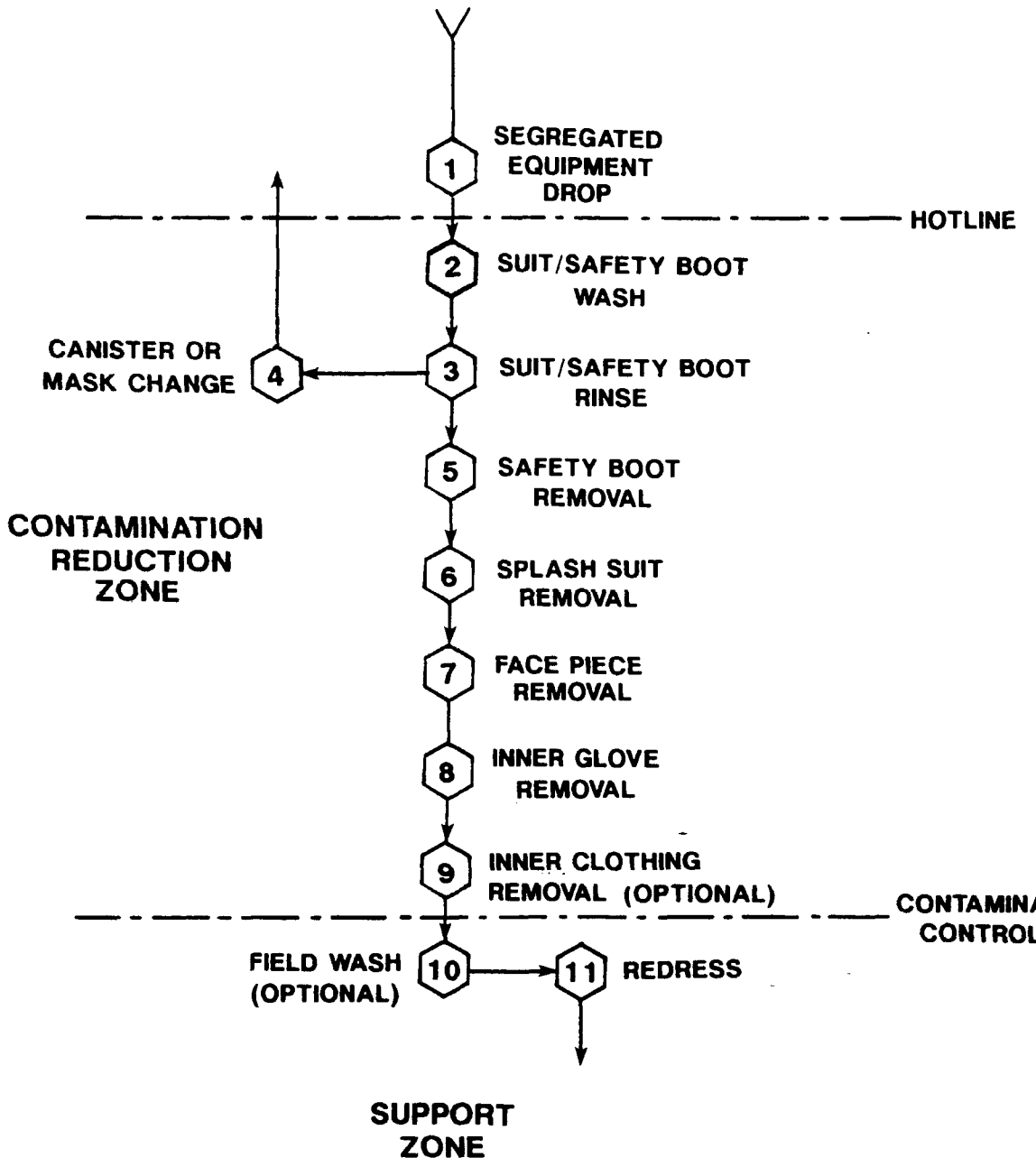


FIGURE 7

HKR 001 1997



HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

DECONTAMINATION LAYOUT LEVEL C PROTECTION

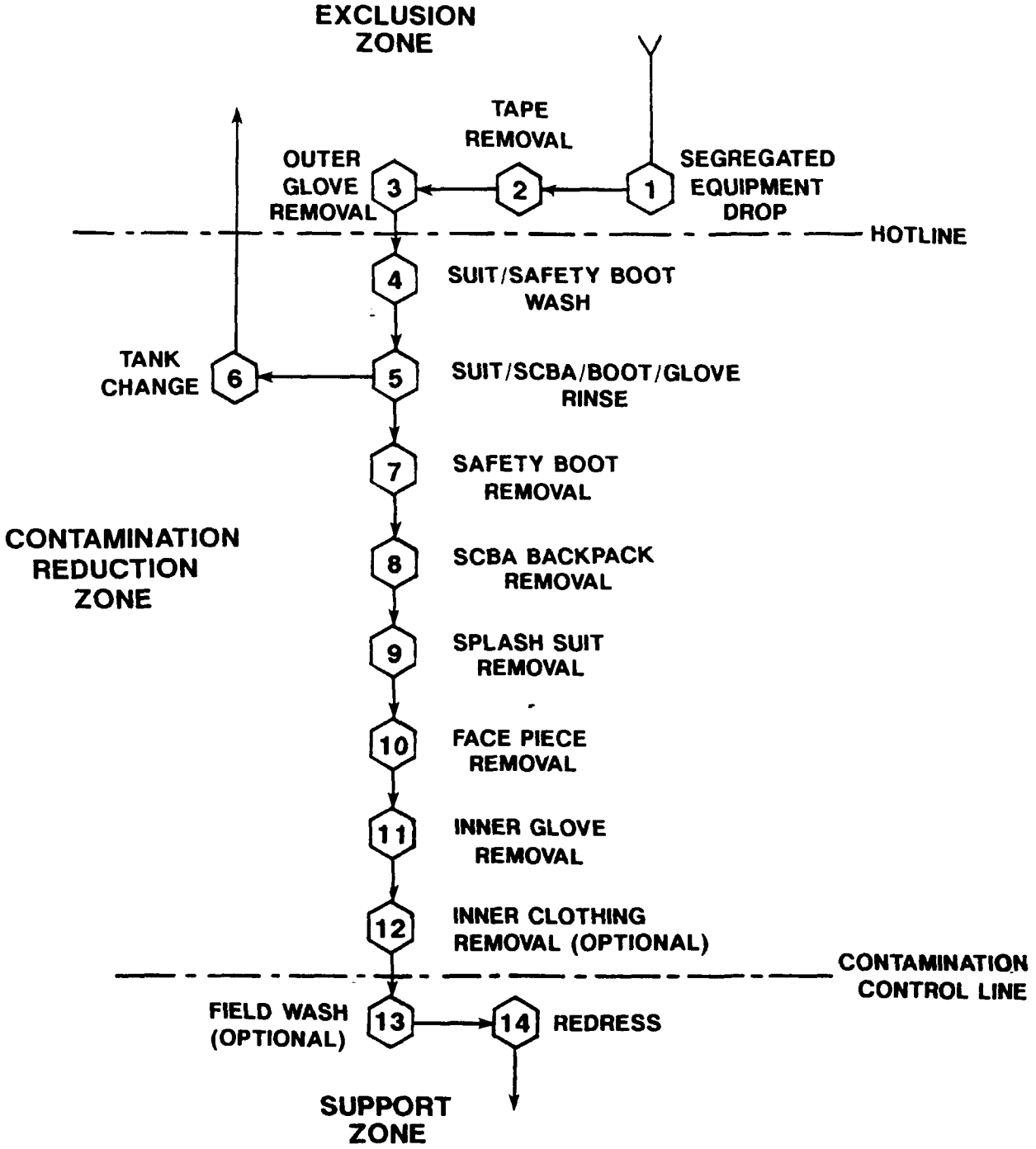
DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
203-762-1207

DATE: 1/10/89

FIGURE 8



HOOKER/RUCO SITE
HICKSVILLE, NEW YORK

DECONTAMINATION LAYOUT LEVEL B PROTECTION

DATE	REVISED

PREPARED BY:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water Consultants
72 Danbury Road
Wilton, CT 06897
203-762-1207

DATE: 1/10/89 FIGURE 9

RADIAN CORPORATION

Chain of Custody Record

Page _____ of _____

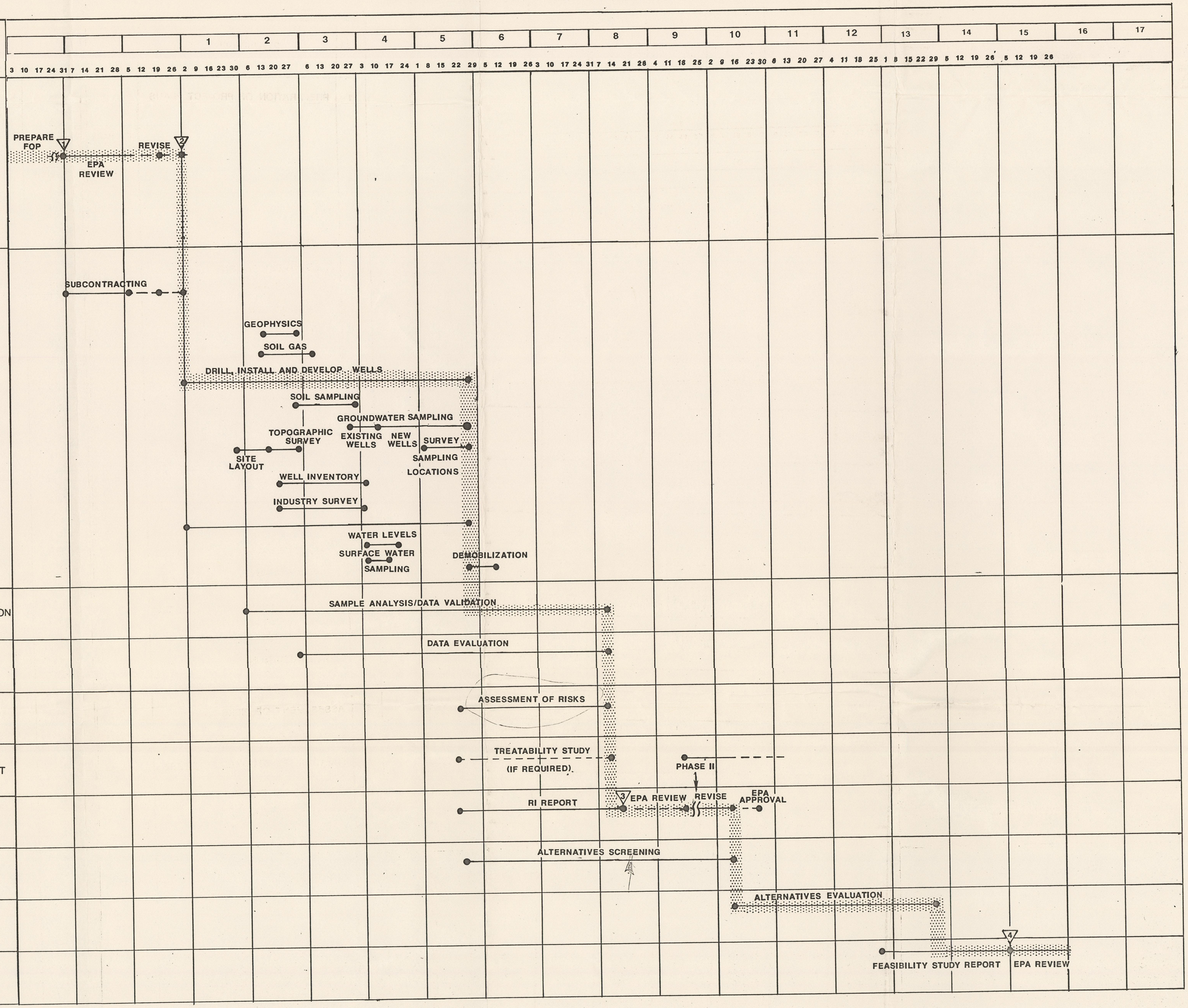
PROJECT			NO. OF CONTAINERS	ANALYSES								REMARKS	SAM ID NO. (for lab use only)
SITE													
COLLECTED BY *(Signature)*													
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME											
REMARKS												RELINQUISHED BY:	DATE / TIME

HER 001 2000

FIGURE 10

TIME FROM APPROVAL OF THE FIELD OPERATION PLAN

TASK	DESCRIPTION
1	PREPARATION OF PROJECT PLANS
2	FIELD INVESTIGATION
	SUBCONTRACTING
	MOBILIZATION
	GEOPHYSICS
	SOIL GAS
	MONITORING WELLS
	SOIL BORINGS AND SAMPLING
	GROUND WATER SAMPLING
	SURVEYING AND TOPOGRAPHIC MAPPING
	WELL INVENTORY
	INDUSTRY INVENTORY
	WATER LEVEL MEASUREMENTS
	SURFACE WATER
	DEMOBILIZATION
3	SAMPLE ANALYSIS/DATA VALIDATION
4	DATA EVALUATION
5	ASSESSMENT OF RISKS
6	TREATABILITY STUDY/BENCH TEST
7	PREPARE RI REPORTS
8	REMEDIAL ALTERNATIVES SCREENING
9	REMEDIAL ALTERNATIVES EVALUATION
10	PREPARE FEASIBILITY REPORT



LEGEND

1	DRAFT FOP	11/1/88
2	FINAL FOP APPROVED	12/31/88
3	DRAFT REMEDIAL INVESTIGATION REPORT	9/15/89
4	DRAFT FEASIBILITY STUDY REPORT	3/15/90
	CRITICAL PATH	

OCCIDENTAL CHEMICAL CORPORATION
HICKSVILLE, NEW YORK

PROJECT SCHEDULE

DATE	REVISED

PREPARED BY:

LEGGETTE BRASHEARS & GRAHAM, INC
Professional Ground Water Consultants
72 Danbury Road
Wilton, CT 06897
203 762 1200

DATE: 10/19/88 PLATE 1

HHR 001 2001

APPENDICES

APPENDIX A

Curricula Vitae

ROBERT LAMONICA

EDUCATION: Bachelor of Arts in Geology, 1974, from State University of New York College at Cortland, New York.

REGISTRATION: Certified as Professional Geologist by the American Institute of Professional Geologists.
Certified as Professional Geologist in Virginia.
Licensed as Professional Geologist in North Carolina.

TECHNICAL SOCIETIES: American Institute of Professional Geologists (Member, Executive Committee, Northeast Section, 1977-1985, Vice President 1985-1986; President 1987-1988);
Association of Ground Water Scientists and Engineers (National Water Well Association);
Geological Society of America;
New England Water Works Association (Member Ground-Water Committee).

SUMMARY OF PROFESSIONAL EXPERIENCE:

1974: (Summer) Hydrologic Field Assistant, Cortland County Planning Board, and Housing and Urban Development Agency.

1976-1979: Hydrogeologist with Leggette, Brashears & Graham, Inc.

1980-1981: Senior Hydrogeologist with Leggette, Brashears & Graham, Inc.

1982-1987: Associate of Leggette, Brashears & Graham, Inc.

1987 to date: Vice President and Director of Leggette, Brashears & Graham, Inc.

Field experience includes supervision of test drilling, geophysical logging, pumping-test supervision and analysis, monitoring of water levels and data correlation for water-supply investigations, and regional ground-water availability studies. Extensive experience with municipal and industrial pollution evaluation and monitoring. Coordination of project management and regulatory agency participation and review. Field investigations in New York, Pennsylvania, Connecticut, New Jersey, West Virginia, Virginia, South Carolina, Oklahoma, Rhode Island, Maryland, North Carolina, and New Hampshire. Project manager on RCRA and CERCLA sites.

Ground-water contamination investigations include wood treatment chemicals, pesticides, herbicides, petroleum products, fertilizer, solvents, plastics, metals, mixed industrial wastes and municipal landfill leachate.

PROJECT-SPECIFIC EXPERIENCE:

Occidental Chemical Corporation:

- Niagara Falls, New York - Field investigator for a plant-wide ground-water contamination study; particular emphasis on the S-Area, including installation and testing of test recovery wells.

- Hicksville, New York - Project Manager for a ground-water investigation of a Superfund site; development of a work plan for an RI/FS; the investigation also included PCB-contaminated soil.

- Bethpage, New York - Provided technical review of the RI/FS process and remedial design for the Old Bethpage Landfill Superfund site, including representation during settlement negotiations.

- Syosset, New York - Technical review of the work plan process and reparation of background documentation for the Syosset Landfill Superfund site.

- Florence, New Jersey - Technical review of the RI/FS and remedial design for the Florence Recontouring Landfill Superfund site, including representation with regulatory agencies.

Mobil Oil Corporation, Newburgh, East Hampton, Port Jefferson, Greenport, Manhattan, New York

Project Manager for hydrocarbon contamination investigations and design and implementation of remedial actions at bulk storage terminals and service stations.

Nabisco Brands, Sag Harbor, New York

Background investigation and review of immediate removal actions and investigations at a Superfund site.

Tighe & Bond, Epping, New Hampshire and Coventry, Rhode Island

Project Manager on State lead Superfund site, subcontracted to Tighe & Bond to perform hydrogeologic investigations and to install and test recovery wells.

Koppers Company, Inc., Florence, South Carolina

Project Manager for extensive remedial investigations, feasibility study and implementation of a ground-water recovery system at a Superfund/RCRA site. The project involved heavier-than-water non-aqueous phase creosote at a wood-treatment plant.

TIMOTHY JOHN YAGLEY

EDUCATION: Western Illinois University, Macomb, Illinois, 1979-1982, B.S.
Western Illinois University, 1982-1985, M.S.
Thesis: The Reaction of Benzoyl Peroxide with N,N-Dimethyl Formamide

MEMBERSHIPS: American Chemical Society, Analytical Division (ACS);
Western New York American Chemical Society, Environmental Sub-Group.

TRAINING COURSES: Purge and Trap Users School, Tekmar, Inc., Cincinnati, Ohio;
Interpretation of Mass Spectra, ASMS Short Course, Denver, Colorado;
Workshop on Environmental Analysis, USEPA and NBS, Gaithersburg, Maryland; and
Fundamentals of Ground-Water Contamination, Geraghty & Miller, Inc.

EXPERIENCE:

June 1988 - present Environmental Chemist: Occidental Chemical Corporation
Environmental Affairs, Niagara Falls, New York

- Coordination of selected analytical programs within Occidental Chemical Corporation Environmental Affairs
- Document production for Occidental Chemical Corporation Environmental Affairs
- Data interpretation

1986 to 1988: Chemist: Occidental Chemical Corporation
Central Sciences, Grand Island, New York

- Supervision of environmental analysis mandated by New York State and EPA Consent Decrees, specifically pesticides and PCB's by EPA 608 and Volatile Organics by EPA 601/602.
- Development of methods for the analysis of organics in environmental samples using various state-of-the-art extraction, derivatization and gas chromatographic techniques.
- Maintenance, repair and updating of analytical equipment.
- Supervision of technicians.
- Supervision of Occidental Chemical Corporation's Sample Management System (SMS), used for managing an environmental sample database within Central Sciences.
- Coordination of analytical activities of California ground-water remediation program.

TIMOTHY JOHN YAGLEY
(continued)

1985 to 1986: Chemist: The University of Iowa State Hygienic Laboratory

- Chromatographer: Fingerprinting and characterizing water and soil extracts for hydrocarbon fuel/oil spills.

- Sample Custody Officer: Primary duties were to log the incoming samples into the Perkin-Elmer LIMS 2000 data system. Also was the primary contact between client and the laboratory, insuring that their analytical request was understood.

1982 - 1985: Teaching Assistant: Western Illinois University

- Supervision of general chemistry and qualitative analysis laboratories, organic chemistry laboratories and a Help Center for chemistry students.

WILLIAM K. BECKMAN

EDUCATION: B.S. in Civil and Environmental Engineering, 1976, from University of Rhode Island.
M.S. in Civil and Environmental Engineering, 1978, from the University of Rhode Island.

REGISTRATION: Registered Professional Engineer in the states of Connecticut, Minnesota and New York.

TECHNICAL SOCIETIES: Member, American Society of Civil Engineers; Association of Ground Water Scientists and Engineers (National Water Well Association).

SUMMARY OF PROFESSIONAL EXPERIENCE:

1976-1978: Research Assistant, Civil Engineering Department, University of Rhode Island.

1978-1980: Hydrologist with Leggette, Brashears & Graham, Inc.

1981-1984: Senior Hydrologist with Leggette, Brashears & Graham, Inc.

1985-1987: Associate with Leggette, Brashears & Graham, Inc.

1987 to date: Senior Associate with Leggette, Brashears & Graham, Inc.

Present duties lie primarily in project management, design of groundwater recovery and treatment systems, environmental assessments for real estate transactions and supervision of computer applications. Recent experience includes management of remedial investigations at three Superfund sites, development and implementation of monitoring program for a major eastcoast refinery, and utilization of 2-D solute transport and 3-D groundwater flow models in hydrogeologic evaluations. Numerous water-supply assessments, including expert testimony, regarding impacts on the hydrogeology. Previous experience includes development, construction and analysis of electrical-analog and digital computer models for ground-water flow and contaminant transport; collection of earth resistivity, seismic and gravity survey data; supervision of well drilling, well development, aquifer testing and analysis of data; geological and geophysical logging; investigation of well loss, water supply, water budget and water-quality (including hazardous waste and hydrocarbons) problems. Office investigations of

projects in North Carolina, West Virginia, Saudia Arabia and Suriname; field experience in Connecticut, Kentucky, Massachusetts, Minnesota, New Hampshire, New York, New Jersey and Pennsylvania.

PUBLICATIONS AND PRESENTATIONS:

"The Ramapo Valley Aquifer Model: A Case Study of Aquifer Modeling for Well Field Management Alternatives", Proceedings of the NWWA Eastern Regional Conference on Ground-Water Management, November 1983.

"Considerations in the Development of a Ground-Water Contaminant Transport Model", presented at the 36th Annual Meeting of the AWWA-Pennsylvania Section, April 1984.

"Computer Aided Design of Ground-Water Monitoring Programs", Proceedings of the ASCE Hydraulics Division Specialty Conference on Hydraulics and Hydrology in the Small Computer Age, August 1985.

"Well Field Management Designed to Minimize Impact on Surface Water Flow", Proceedings of the ASCE Symposium on Engineering Hydrology, August 1987.

CONTINUING EDUCATION:

- "Modeling Pollutant Movement", University of Wisconsin-Extension, 5 days, 1981.

- "Ground-Water Contamination, Part A: Mass Transport", Dr. George Pinder, BSCES/ASCE Geotechnical Lecture Series, 1981.

- "Health and Safety Training", by Steven Maslansky, Geoenvironmental Consultants, Inc., 3 days, 1983.

- "The Design of Air-Stripping and Carbon Adsorption for Treating Contaminated Groundwater", sponsored by Massachusetts Water Works Association and Waste and Wastewater Operations Center, 2 days, 1984.]

- "Achieving Excellence", Career Track, Inc., 1 day, 1986.
- "Project Management", Management Development Program of the School of Business Administration, University of Connecticut, 2 days, 1987.

- "TR-55 Urban Hydrology Workshop", USDA/Soil Conservation Service, 1 day, 1987.

- "Risk Assessment for the Ground Water Hydrologist", National Water Well Association, 3 days, 1988.

PROJECT SPECIFIC EXPERIENCE:

- Apple Valley, Minnesota - Design and implementation of a recovery/-treatment system to eliminate free hydrocarbon product and reduce to acceptable levels the dissolved components of hydrocarbons in the water table aquifer at the Williams Pipe Line Company's Rosemount Terminal.

- Brooklyn, New York - Monitoring of fluid levels and conducting aquifer pump tests in order to define the extent of hydrocarbon product and implement a recovery system at a Mobil Oil terminal and tank farm. Computer evaluation of various recovery techniques.

- Deepwater, New Jersey - Development of a computer program which contoured water-level and water-quality data for use in monitoring the multi-aquifer system and evaluating the effectiveness of the recovery well system in containing and reducing chemical concentrations at the E. I. du Pont de Nemours & Company, Inc.'s Chambers Works facility.

- East Meadow, New York - Data collection and monitoring for the evaluation of a gasoline leak from an Exxon service station. Use of computer modeling to test various schemes for the recovery of floating product and to estimate the extent of the plume of dissolved hydrocarbon components and their potential for further migration.

- Florence, South Carolina - Collection of water samples from residential and commercial supplies near a Koppers Company wood-treatment facility as part of an investigation to define contamination of the ground-water system by wood-preservative chemicals.

- Hillburn, New York - Investigation into the occurrence of TCE in a water-supply well of the Spring Valley Water Company. Evaluation of travel times for backtracking to possible sources, as well as estimation of future movement. Recommendations for well-field operation to minimize capture of TCE and prevent contamination of remaining wells.

- West View, Pennsylvania - Development of a ground-water computer model to evaluate proposed remedial measures to prevent the further contamination of West View Municipal Authority water-supply wells from chemicals emanating from a nearby chemical plant.

- Plumstead Township, New Jersey - Project Manager of hydrogeologic investigations for the RI/FS at three Superfund sites. These studies at Pijak Farm, Spence Farm and Goose Farm are directed at defining the extent of contamination and evaluating alternatives for remediation. Investigative techniques included electromagnetic terrain conductivity and multi-level monitor wells.

PROJECT SPECIFIC EXPERIENCE: (continued)

- East Brunswick, New Jersey - Preliminary computer model evaluation to assess the threat of a contaminant plume on nearby water-supply wells.

- Paulsboro, New Jersey - Assist in the evaluation and design of liquid hydrocarbon recovery system installed in the water-table aquifer at the Mobil Oil Corporation refinery. Periodic review of recovery system to ensure continued operation. Computer modeling to evaluate effectiveness of recovery system and estimate remaining product in aquifer. Design and implementation of an investigation and monitoring program for potential contamination in deep aquifers at the site. Alternatives for remediation were evaluated and a recommendation made to the client.

- East Syracuse, New York - Design of a hydrocarbon/ground-water recovery system at a Conrail switching yard to remediate a problem of diesel fuel in the soils. Engineering drawings and specifications provided to send to contractors for bidding.

- Greenwich, Connecticut - Design of a hydrocarbon/ground-water recovery system at a Northeast Utilities maintenance garage. The system included wells equipped with air-ejector pumps which discharged to a treatment unit. Engineering drawings and specifications were provided for contractor use and as-built drawing supplied at end of work.

- New Windsor, New York - Design of a hydrocarbon/ground-water recovery system at a Mobil Oil Corporation terminal/ tank farm. The system included a high capacity recovery well, equipped with a pump that discharges to an airstripper. Effluent from the airstripper flows to the municipal sewer. The system was equipped with automatic controls and winterized to allow year-round operation.

- Suffern, New York - Technical manager of computer modeling of TCEA plume in the vicinity of the Suffern municipal well field. The solute transport model was developed from field data obtained during the Remedial Investigation (RI) and was used to evaluate alternatives during the Feasibility Study (FS) for this Superfund listed listed site.

PROJECT SPECIFIC EXPERIENCE: (continued)

- Connecticut and New York - Numerous environmental assessments of properties to define site conditions and potential risks associated with hazardous or toxic chemicals. Information developed used by involved parties prior to transfer of property ownership or refinancing.

cntmn
wkb:7/26/88

DOUGLAS E. SIMMONS

EDUCATION: Attended U. S. Coast Guard Academy, 1970-1972. Bachelor of Arts in Earth Science/Chemistry, 1974, from Western Connecticut State College. Master of Science in Geology, 1983, from University of South Florida.

TECHNICAL SOCIETIES: Association of Ground Water Scientists and Engineers (National Water Well Association).

SUMMARY OF PROFESSIONAL EXPERIENCE:

1973: (Summer) Field Helper, Layne-New York Co., Inc. (Water-well drilling activity).

1974-1975: Geologic Technician and Office Manager, Layne-New York Co., Inc., Linden, New Jersey Field Office.

1975-1979: Hydrogeologic Assistant with Leggette, Brashears & Graham, Inc.

1979-1980: Hydrogeologist with Leggette, Brashears & Graham, Inc.

1980-1985: Senior Hydrogeologist with Leggette, Brashears & Graham, Inc.

1986 to date: Associate with Leggette, Brashears & Graham, Inc.

Experience includes water-supply investigations and development; ground-water availability studies; pollution evaluation and monitoring; evaluation and removal of hydrocarbon contaminants; and mine dewatering programs. Field experience includes geophysical logging of wells; television surveys of well structures; planning and conducting pumping tests; processing and analyzing aquifer test data; supervision of well drilling and development; water-quality sampling; and performance of basic data collection programs. Field investigations in 10 states in the northeastern, southeastern and midwestern United States and in Canada.

PROJECT-SPECIFIC EXPERIENCE:

- Burlington, New Jersey - Supervision of monitor well drilling leading to the evaluation of industrial chemical contamination of the ground-water system from past and present operation of a Hooker Chemicals and Plastic Corporation facility. 1983 - ongoing.

- Minneapolis-St. Paul area, Minnesota - Field supervision of investigations for 10 gasoline and fuel oil spills from pipeline leaks. Evaluation of data from test borings, monitor wells, pumping tests and water-quality sampling to develop recommendations to the Williams Pipe Line Company for remedialaction. Implementation of recommendations. 1982 - ongoing.

- Strang, Oklahoma - Supervision of monitor well drilling and evaluation of hydrogeology with respect to the potential migration and the recovery of liquid fertilizer from a pipeline break for the Williams Pipe Line Company. 1982 - 1983.

- Suffolk County, New York - Aquifer test analysis and hydrogeologic review to define the potential of low level nuclear waste contamination to nearby public supply wells of the Suffolk County Water Authority. 1983.

- Waynesboro, Virginia - Hydrogeologic evaluation of mercury contamination based on ground-water flow and quality data developed from a monitoring well system at the E. I. du Pont de Nemours & Co., Inc. plant. 1980.

- Stamford, Connecticut - Evaluate the ground-water contamination from a bulky waste site, including, monitor well drilling and sampling and preparation of an ongoing monitoring program. 1983 - ongoing.

- Haddam, Connecticut - Develop a replacement cooling water supply for an atomic energy plant at which the existing supply had been thermally contaminated. Prepared monitoring program to insure continuing supply of cool water. 1984 - ongoing.

- West Chester, Pennsylvania - Conduct a ground-water investigation at a chemical plant to determine the extent of TCE contamination in a shallow bedrock aquifer. 1984 - ongoing.

WILLIAM T. WEST

EDUCATION: Bachelor of Science in Geology, 1986, from Long Island University, Southhampton College, Southhampton, New York. Field Geology, 1985, Iowa State University, Des Moines, Iowa, Shell, Wyoming.

TECHNICAL SOCIETIES: National Water Well Association (Ground-Water Scientists and Engineers Division).

SUMMARY OF PROFESSIONAL EXPERIENCE:

1985-1986: Hydrogeologic Technician with Leggette, Brashears & Graham, Wilton, Connecticut.

1987-1988: Hydrogeologist with Leggette, Brashears & Graham, Inc.

1988 to date: Senior Hydrogeologist with Leggette, Brashears & Graham, Inc.

Hydrogeologic experience includes drilling supervision, design and installation of test boring, monitor, interceptor, recovery and supply wells; testing supervision including constant rate, step, residual drawdown and slug testing; pump test data analysis; sampling of both clean and contaminated soils and ground water; NPDES, SPDES, RCRA and CERCLA sampling; geophysical investigations using seismic refraction and geophysical logging methods; chemical and physical well redevelopment supervision to improve well capacities; fracture-trace analysis for determining optimal water-supply well locations; water resource and quality assessments for both property transfers and public water supply projects; hydrocarbon recovery system's installation, monitoring and evaluation, all phases of report preparation with experience in drafting and computer generated graphics; filed projects in Connecticut, Rhode Island, Massachusetts, New York, New Jersey, Pennsylvania and South Carolina.

PROJECT SPECIFIC EXPERIENCE:

- Binghamton, New York - Drilling and sampling of monitor wells in an active waste landfill to determine soil and ground-water quality. The results of the investigation provided the basis for closure of the landfill in 1987.

- East Syracuse, New York - Performed tests borings and monitor well installation in and adjacent to a waste oil wagon to access soil quality and define the extent of free-phase hydrocarbon migration.

PROJECT SPECIFIC EXPERIENCE: (continued)

- Brooklyn, New York - Conducted testing and evaluation of six hydrocarbon recovery wells with free-phase hydrocarbon present in the unconfined and semi-confined aquifers. Current recovery estimates show an excess of 800,000 gallons of hydrocarbon have been recovered and recent review has lead to the detection of additional leakage at the facility.

- Mount Vernon, New York - Installation and maintenance of hydrocarbon recovery systems, which include separate water pumps, hydrocarbon recovery equipment and an air-tower unit; also initiated a sampling and monitoring program in accordance with the SPDES Permit.

- East Hampton, Connecticut - Supervision of monitoring well installation and pump testing to aid in design of both interceptor and recovery systems for dissolved and free-phase contamination in a bedrock aquifer; also conducted monitoring and sampling to identify and define the area impacted.

- Plainville, Connecticut - Installation, testing and monitoring of a hydrocarbon recovery system with included separate water pumps and hydrocarbon recovery equipment. Also conducted sampling in accordance with the NPDES Permit. Performed a feasibility study to determine potential contributors within the watershed boundaries. Supervision of monitor well stabilization to define the areal extent of floating hydrocarbon product.

- Hicksville, New York - Conducted soil sampling to define the extent of PCB contamination and performed ground-water monitoring to determine volatile organic contamination migration potentials.

- New Britain, Connecticut - Manage, supervise and perform a Phase I environmental assessment of the active industrial manufacturing facility. Investigation included installation of numerous test borings and monitor wells and sampling and definition of area impacted with total petroleum hydrocarbon metals and solvents.

PROJECT SPECIFIC EXPERIENCE: (continued)

- Chambers Works, New Jersey - Conducted monitoring and pump testing a a chemical company facility with TEL contamination to determine recovery and containment effectiveness.

- Repauno, New Jersey - Active involvement in pump tests and monitoring programs to evaluate recovery and interceptor well systems and their effectiveness in containing TCE migration. The testing included analysis of adjacent public water supply systems.

- Paulsboro, New Jersey - Supervision of pumping test conducted in a semiconfined aquifer with free-phase hydrocarbon contamination using pressure transducers for data retrieval. The investigation included trial influence analysis, provided interpretation of aquifer leakage and define to area of influence.

- Stoney Point, New York - Conducted a property assessment which included supervision of well point and monitoring well installation and employed soil and ground-water sampling to define the area impacted by industrial solvents. The investigation provided alternatives for recovery of the contamination.

- Florence, North Carolina - Provided drilling supervision of cluster wells; completed hydraulic testing and reviews water quality to assess a major wood-treating facilities adverse effect on the environment. The investigation was designed to determine the extent of areas impacted by heavier than water, wood-preservative chemicals.

- Cranston, Rhode Island - Installation, sampling and monitoring of hydrocarbon recovery system including air pumps, aereators and carbon filters.

- Portland, Connecticut - Supervision of test boring and monitor well installation for a property assessment at an active gasoline station. The investigation was used to determine both soil and ground-water quality and the results were incorporated for the property transfer.

- Branford, Connecticut - Performed property assessment including research of past land uses, soil sampling and recommendations for remedial action for pesticides and benzene contamination.

EDWARD J. DESTEFANIS

EDUCATION: Bachelor of Science in Geology, 1986, from Southhampton College, Long Island University.

TECHNICAL SOCIETIES: National Water Well Association;
Association of Engineering Geologists.

SUMMARY OF PROFESSIONAL EXPERIENCE:

1986: Hydrogeologic Technician with Leggette, Brashears & Graham, Inc. (Cooperative Education Program).

1987 to date: Hydrogeologist with Leggette, Brashears & Graham, Inc.

Field experience includes monitoring various water supply and recovery well system pumping tests, collection of both clean and contaminated water samples, soil sampling for RCRA sites; trained in health and safety operations at hazardous material sites, soil-gas surveys, sieve and bulk density analysis, geophysical logging, technical computer experience, knowledge of database management, spreadsheets, BASIC programming and knowledge of computer graphics, which includes TOPO and SURF; compiled computer-generated tables, hydrographs and chemographs.

stnd:9-88

R. DALE BRAUE

EDUCATION: Associate of Applied Sciences in Ecology and Environmental Technology, 1983, from Paul Smith's college of Arts and Sciences.
Bachelor of Science in Watershed Science, 1986, Utah State University.

SUMMARY OF PROFESSIONAL EXPERIENCE:

1984 - 1986: Water Quality Technician, Utah Water Research Laboratory, Utah State University.

1987 to date: Geohydrologist with Leggette, Brashears & Graham, Inc.

Current primary responsibility is to conduct soil-gas surveys using a portable gas chromotograph. Analysis includes instrument standardization with computer-aided interpretation. Present duties include data entry and interpolation, field sampling and research site selection. Immediate experience includes surface hydrology and ground-water contamination sampling. Previous experience includes water-quality analysis of public and private culinary water, surface water, municipal and industrial waste. Responsibilities included analysis for EPA audits and determination of laboratory simulation techniques for water purification research.

stnd:8/88

LAURA G. HANSON

EDUCATION: Bachelor of Science in Civil and Environmental Engineering, 1986, University of Rhode Island.
Master of Science, Civil and Environmental Engineering, 1988, University of Rhode Island.

REGISTRATION: Engineer-in-Training Certificate, 1986, Kingston, Rhode Island.

TECHNICAL SOCIETIES: Associate Member, American Society of Engineers;
Association of Ground Water Scientists and Engineers (National Water Well Association).

SUMMARY OF PROFESSIONAL EXPERIENCE:

1983-1984: Engineering Technician with Marine Ecosystems Research Laboratory, University of Rhode Island, Graduate School of Oceanography.

1984-1986: Environmental Research Engineer with Rhode Island Department of Environmental Management, Groundwater Protection Section.

1986-1988: Graduate Research Assistant, Civil Engineering Department, University of Rhode Island.

1988 to date: Hydrogeologic Engineer with Leggette, Brashears & Graham, Inc.

Experience includes research for environmental assessments dealing with real estate transactions and historical background information at State and local agencies; preparation of blueprints and development of specifications for ground water remediation systems;and evaluation, organization and graphical presentation of hydrologic monitoring data. Previous field experience includes installation of shallow ground-water wells to monitor ground-water levels and quality; supervision of river water quality surveys; evaluation of soil erosion characteristics using the Particle Entrainment Simulator (PES) on New York Bight sediment aboard the NOAA Albatross IV research vessel and Pawtucket River sediment. Soil classification included, but was not limited to, erosion rates, particle distribution, water content, density and shear force analysis.

stnd:10-88

APPENDIX B

PHOTOVAC TIP

Turn power on by first pulling switch out away from instrument and then move up. Allow TIP to warm up for approximately 5 minutes before attempting use.

Calibration Procedure

1. Be sure LOBAT symbol does not appear in upper left corner of LCD display. (Battery charging procedure follows narrative for use.)

2. Allow TIP to sample clean air - instrument can be calibrated to ambient air, however, do not attempt to calibrate in an area you know contains volatile organic vapors (around gas pumps, downwind of diesel or other exhausts, etc.).

3. Adjust ZERO control knob (first loosen locking ring by turning clockwise) until LCD display reads 00.0 or nearly so. (For TIP I there is a coarse zero adjustment located on the back of the TIP, behind the LCD display, looking down on the instrument from the top. Use the fine screwdriver to turn the screw potentiometer until the LCD reads 00.0 or nearly so. Then use ZERO knob to fine adjust.)

4. Attach regulator to 100 ppm isobutylene span gas bottle and open slightly for a split second (purges inside of regulator). Attach tedlar bag marked 100 ppm to the regulator, fill the bag, then attach it to the inlet of the TIP and adjust SPAN knob (unlock ring by turning clockwise) until LCD reads 100 or nearly so (the older TIP is extremely sensitive so the slightest rotation of the knob will produce

a large change in the reading. As you relock the ring by turning counterclockwise be sure the reading stays at 100).

5. Allow TIP to sample clean air and readjust zero if LCD doesn't come to 00.0 after 1 minute.

6. Attach regulator to 10 ppm isobutylene span gas bottle and purge, fill tedlar bag marked 10 ppm and attach to TIP inlet. LCD should read 5 to 15. Anywhere in this range is okay (TIP is less sensitive at low concentrations). A reading above 15 or below 5 indicates a problem:

a. Filter element may be clogged. Using two 9/16-inch or adjustable wrenches, unscrew the top of the filter housing (the silver tip of the instrument). Be sure to hold the filter housing at its base while unscrewing the housing top or the entire housing will become loose and leak. Remove silver filter element (watch for spring) and replace with a new element. Recalibrate.

b. Recalibrate. If this fails to correct the 10 ppm calibration, the instrument should not be used unless the numbers are <u>strictly</u> used for screening purposes only. Report the malfunction as soon as TIP is returned to office.

7. TIP is now ready for use. It is best to collect as many soil samples as practical for that job, turn on TIP to test those samples and then turn off. If each split spoon or other sample needs to be examined, leave TIP on for as long a time as is practical. Do not turn on and off every few minutes. A full battery charge will last from 2 to 4 hours, total running time.

8. Samples should be collected and sealed in clean glass jars. Do not leave these in direct sun or in a hot

closed car. To take a reading, open lid enough to insert the TIP inlet (attach small sampling tube if necessary) and make note of the values. Aluminum foil or "Para-film" can be used to seal the jars instead of the lids in which case use the sampling tube to pierce the seal. Avoid allowing suction pump to pull liquid or dirt into the TIP. If this occurs, immediately turn instrument off and clean out filter housing. If water has entered do not attempt to use TIP until it has been checked. Water will short circuit the electronics.

9. Keep a record of what the maximum TIP reading is (represents the head space volatile fraction) and what numbers the LCD seems to stabilize at (represents what the sample continuously degases). Note the moisture content of the sample as high humidity causes negative readings (not a problem when values are in excess of 50 ppm).

10. To turn off, lift switch towards you and move down to off position.

11. Battery charging - instrument cannot be used when battery charger is plugged in. Do not attempt to do this under any circumstances. Connect charger plug to the base of the instrument and then plug AC converter into a wall outlet. TIP should receive a full 16-hour charge prior to use, however, if LOBAT indicator does not appear while using, do not recharge the batteries. If the TIP is put on charge before LOBAT appears, the operating time of the instrument is diminished eventually causing destruction of the batteries.

12. Notes:

a. When TIP is first turned on, the LCD and the twin yellow LED's will come on. Up to 5 minutes may be

necessary for the pump to turn on, after which a 3 or 4-minute warm up period is necessary.

b. The baseline zero will drift with continued use. There is no need to continuously rezero, just note the new "zero" point. Drift is normally towards more negative numbers.

c. The maximum reading of the instrument is 1,999.9 ppm. Values greater than this will result in a "1" appearing in the extreme left portion of the display. Note this as 2,000 ppm "plus".

d. The TIP can be calibrated for a specific compound if this application is needed. The calibrant gas isobutylene is used because of the TIP's medium sensitivity to it. The TIP is twice as sensitive to benzene as isobutylene. If needed in this application, please receive instruction prior to use.

e. At best, the TIP is a fairly accurate screening tool. Numbers on the LCD do not necessarily reflect the level of contamination. The TIP is not a quantitative device.

HNU MODEL HW-101

Meter Use

1. Unclamp the cover from the main readout assembly and connect the probe cable to the 12 pin keyed connector on the readout assembly panel.

2. Screw the filter nozzle securely into the probe end cap.

3. Check the battery operation. Turn the function switch to the BATT position. If the battery is fully charged, the needle should move to the right and go into the green zone of the scale. If the needle is below the green zone or if the low battery indicator comes on, the batteries must be recharged.

4. Check the zero adjustment. Turn the function switch to the STANDBY position. The needle should align with the zero position on the scale. If this does not occur, then adjust the needle until a zero reading is achieved using the zero adjustment.

5. Select an appropriate operating range using the function switch. It is recommended that the user start with a 0 to 2,000 position and switch to a more sensitive range as required. Once the appropriate operating range has been selected, the instrument is now operational and ready for use.

Calibration Procedure

1. Attach the regulator to the calibration cylinder which has a mixture of 100 ppm isobutylene in pure air. Attach the analyzer directly to the output of the regulator using a short piece (butt connected) of flexible tubing.

2. Open the regulator and allow the calibrant gas to flow directly from the cylinder to the analyzer.

3. Unlock the span control knob on the main readout assembly by turning the locking mechanism counter-clockwise. Adjust the span control knob to read the required setting shown on the calibrant cylinder. (Note, the span knob should be set at 9.8 and the

needle should read 57 ppm when the function switch is positioned on the 0 to 200 scale, using a 10.2 eV lamp and 100 ppm isobutylene calibrant gas.) After setting the span knob to the correct setting, relock the knob by turning the locking mechanism clockwise.

4. After adjusting the span knob, set the function switch back to STANDBY position and recheck the zero setting. If the zero setting requires adjustment, complete the adjustment and recalibrate the span setting using the calibrant gas.

5. If the span setting is less than 9.0, after zero readjustments, or calibration cannot be achieved, then the lamp bulb must be cleaned.

Lamp Cleaning

1. The function switch must be in the off position prior to disassembling the instrument.

2. Disassemble the probe following directions outlined in Paragraph 6-2.1 of the operation manual.

3. Clean the lamp bulb with a mild detergent, rinse with deionized water and wipe dry with lens paper.

4. If rigorous cleaning of the lamp bulb is required, clean the lamp with special HNU cleaning compound supplied by the manufacturer.

5. Reassemble the probe and recheck the calibration of the analyzer.

cmp
April 20, 1989
88r17

APPENDIX C

PROTOCOL FOR SCREENING SOIL SAMPLES FOR VOCs

Equipment:

TIP or HNU
Sample jars with lids (approximately 40 milliliter)
Aluminum foil
Rubber band

Procedure:

1. Transfer a representative portion of the sample into the sample jar. Close the split spoon to minimize volatilization.
2. Seal the jar with a piece of the aluminum foil and secure it with a rubber band.
3. Store the sample in a warm area (25°C minimum).
4. In order to take a measurement, push the intake probe of the instrument through the aluminum foil, taking care not to allow soil or water to enter the intake.
5. Record the highest reading, which usually occurs within 5 seconds of puncturing the seal. Record measurement on log. Allow meter to return to zero before next measurement.
6. If the readings are above 5 ppm, handle the sample as specified in Appendix J so that the sample can be analyzed.

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April 20 , 1989
88r17

APPENDIX D

ORION RESEARCH MODEL 399A/F pH METER

Meter

1. Check zero adjustment. With the function switch in the OFF position, the needle should point to exactly center scale. If not, turn the zero adjust screw with a small screwdriver until the needle is on exactly center scale.

2. Check batteries (for battery operation). Disconnect meter from line power. Turn function switch to the BATT position. If the needle does not stop in or to the right of the green BATT OK arc on the meter, recharge batteries by connecting meter to line power. Meter is operable during recharging on-line power.

3. Slip electrode holder onto support rod. Adjust holder to desired height and tighten thumbscrew at the rear of the holder.

4. Drop electrodes into the holder making certain that 92 and 95 Series electrodes are mounted at a 20° angle. Push electrodes down into the holder as far as they will go.

5. Insert the sensing electrode connector into the large input jack on the instrument panel until it clicks.

6. Insert reference electrode connector into the small red input jack on the instrument panel. Instrument is now ready to use.

Calibration and Use

1. Select two buffers, the first with a pH of 7. Select a second buffer (pH 4 or pH 10) so that the two

buffers bracket the anticipated sample pH. Warm buffers to 25°C.

2. Remove cover from reference solution filling port, place pH and reference electrodes or combination electrode in pH 7 buffer solution.

3. Turn the calibration control until the needle (on the black scale) points to the pH value of the buffer.

4. Remove electrodes from the pH 7 solution. Rinse with distilled water and place in the second buffer solution.

5. Turn the temperature compensator knob until the meter needle points to the pH value of the second buffer solution.

6. Turn the slope indicator until the arrow of the temperature compensator points to the temperature of the solution. The percent of theoretical slope can be read on the slope scale. A slope of less than 90 percent may be caused by a defective pH electrode or a contaminated buffer solution.

7. To take pH reading of unknown solution, adjust temperature compensator to temperature of the sample and place electrode into sample. Read the pH value of the unknown on the black pH scale. Rinse probe with distilled water.

8. Store pH probe in pH 7 buffer.

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88r17

APPENDIX E

Y.S.I. MODEL 33 CONDUCTIVITY/SALINITY/TEMPERATURE METER

Setup

1. Adjust meter zero (if necessary) by turning the bakelite screw on the meter face so that the meter needle coincides with the zero on the conductivity scale.

2. Calibrate the meter by turning the MODE control to REDLINE and adjusting the REDLINE control so the meter needle lines up with the redline on the meter face. If this cannot be accomplished, replace the batteries.

3. Plug the probe into the probe jack on the side of the instrument.

4. Put the probe in the solution to be measured. (See Probe Use.)

Temperature

Set the MODE control to TEMPERATURE. Allow time for the probe temperature to come to equilibrium with that of the water before reading. Read the temperature on the bottom scale of the meter in degrees Celsius.

Conductivity

1. To check calibration, immerse probe in 25°C conductivity standard solution of 447 umhos or 2,070 umhos, depending on the expected conductivities of the samples. If the reading is inaccurate, clean probe. If still inaccurate, replatinize probe.

2. Switch to X100. If the reading is below 50 on the 0-500 range (5.0 on the 0-50 mS/m range), switch to X10. If the reading is still below 50 (5.0 mS/m), switch to the X1

scale. Read the meter scale and multiply the reading appropriately. The answer is expressed in micromhos/cm (mS/m). Measurements are not temperature compensated.

3. When measuring on the X100 and X10 scales, depress the CELL TEST button. The meter reading should fall less than 2 percent; if greater, the probe is fouled and the measurement is in error. Clean the probe and remeasure.

NOTE: The CELL TEST does not function on the X1 scale.

Salinity

1. Determine the sample temperature and adjust the temperature dial to that value.

2. Switch to X100. If the reading is above 500 micromhos/cm (50 mS/m), the salinity value is beyond the measurement range.

3. If the reading is in range, switch to SALINITY and read salinity on the red 0-40 ppt meter scale.

4. Depress the CELL TEST button. The fall in meter reading should be less than 2 percent; if it is greater, the probe is fouled and the measurement is in error. Clean the probe and remeasure.

PRESTO-TEK DSPH-3 PH/CONDUCTIVITY METER
(readings are automatically temperature compensated to 25°C)

Calibration

pH Mode:

1. Remove protective bottle from pH probe.

2. Rinse pH probe with distilled water.

3. Insert pH probe in pH 7 buffer at 25°C. Allow probe to equilibrate to the temperature of the buffer.

4. Slide back the battery compartment cover to the first stop exposing the adjustment pots.

5. Adjust the CAL pot until the display reads 7.00.

6. Remove probes, rinse with distilled water and insert in pH 4 or pH 10 buffer at 25°C.

7. Adjust SLOPE pot until the display reads the correct value.

8. Repeat Steps 2 through 7 until no further adjustments are necessary.

9. Store pH probe in protective bottle with pH 4 buffer.

Conductivity Mode

1. Rinse probes thoroughly with distilled water.

2. Wipe off conductivity probe and allow to dry.

3. Once dry, conductivity should read 0 in air.

4. Adjust ZERO pot if reading is incorrect.

5. Immerse probes in 25°C conductivity standard solution of 447 umhos or 2,070 umhos, depending on the expected conductivities of the samples. Adjust SPAN pot to the correct value.

6. Rinse probes with distilled water.

Measurements

1. Remove protective bottle from pH probe.

2. Rinse probes with distilled water.

3. Immerse probes one-half their length in sample.

4. Allow probes to equilibrate with the temperature of the sample.

5. Record pH value once reading has stabilized.

6. Record conductivity value on the lowest range possible (0-200,000 umhos, 0-20,000 umhos, 0-2,000 umhos).

7. Thoroughly rinse probes with distilled water and install protective bottle or pH probe.

cmp
April 20, 1989
88r17

APPENDIX F

PROTOCOL FOR SAMPLING GROUND WATER BY BLADDER PUMP

Equipment:

Bladder pump
Air compressor
Cycle controller
Teflon lined polyethylene tubing
Measuring tape and chalk (M-scope)
Sample bottles
0.45 um filters
Graduated bucket
Distilled water
Rags
Alconox^{tm} laboratory cleaner
Sample containers
Polyethylene sheeting
pH meter and buffers
Test tube or vials
Conductivity meter and standard
Gloves (Latex, Nitrile, or equivalent)
Thermometer

Procedure:

1. Unlock the well and measure the depth to water with a chalked tape or M-scope to the hundredth of a foot. Calculate the amount of water standing in the well.
2. Lower the clean bladder pump with dedicated Teflon lined discharge tubing down the well and secure the pump directly below the measured water surface. Attach air source to bladder pump.
3. Periodically measure the flow rate using a graduated bucket. Operate the pump in a continuous manner to avoid aerating the samples. When collecting samples for volatile organics, TOX and TOC pumping rates will not exceed 100 milliliters per minute. Record pumping rates on sampling log. The pump will be lowered as required, to account for drawdown in the well and to ensure that all standing water has been removed.

4. Pump three times the amount of standing water from the well before sampling. Put on protective gloves.
5. While the well is being evacuated, the pH, conductivity and temperature will be monitored to confirm that formation water is being sampled.
6. If dissolved metals sampling is to be performed, attach an in-line 0.45 micron filter with cellulose acetate filter media and either polypropylene or polyethylene housing, or performance equivalent to the discharge tube and direct sample to container. Add preservatives as required.
7. Fill containers and place all filled containers in cooler with ice. The bladder pump will be operated in a continuous manner so that it does not pulsate, which may cause aeration in the return tube or discharge. Note: Do not rinse bottles with sample water before filling. Volatile vials are to be filled first.
8. Complete water sampling log and chain-of-custody form.
9. Lock well and deliver samples to the shipping courier. Place airbill number and signature on chain-of-custody. Samples will be sent via overnight courier to the laboratory.

dmt
August 2, 1989
89r11

10. Project Organization and Responsibility

The following is a list of key project personnel and their corresponding responsibilities:

Leggette, Brashears & Graham	- sampling operations
" " "	- sampling QC
T. Yagley, OCC	- laboratory analysis
W. Leroux, OCC	- laboratory QC
T. Yagley, OCC	- data processing activities
T. Yagley, OCC	- data processing QC
T. Yagley, OCC	- data quality review
W. Leroux, OCC	- performance auditing
W. Leroux, OCC	- systems auditing
W. Leroux, OCC	- overall QA
A. Weston, OCC	- overall project coordination

(Note: an organizational chart should be supplied with this plan)
See Figure 1.

11. Data Quality Requirements and Assessments

Parameter	Sample Matrix	Detection Limit	Quantitation Limit	Estimated Accuracy	Accuracy Protocol	Estimated Precision	Precision Protocol

See attached table 2

APPENDIX G

Table 1

Parameter/ (# of Samples)	Method Reference	Matrix	Sample Preservation	Holding Time	Sample Size; Container
TCL Semi-VOA's & MOCA (135 + QA[7])	EPA SOW 288[1] (MOCA method attached)	Soil	4°C	extract in 10 days, analyze in 40 days	8 oz glass
TCL Pest/PCB's (135 + QA[7])	EPA SOW 288[1]	Soil	4°C	extract in 10 days, analyze in 40 days	8 oz glass
TCL VOA's (135 + QA[7])	EPA SOW 288[1]	Soil	4°C	analyze in 10 days	2 x 40 mL glass, Teflon lined septum
TCL Semi-VOA's & MOCA (42 + QA[7])	EPA SOW 288[1] (MOCA method attached)	Water	4°C	extract in 5 days, analyze in 40 days	1 liter; glass
TCL Pest/PCB's (42 + QA[7])	EPA SOW 288[1]	Water	4°C	extract in 5 days, analyze in 40 days	1 liter; glass
TCL VOA's (42 + QA[7])	EPA 524.2	Water	pH<2 1:1 HCl	analyze in 10 days of receipt	2 x 40 mL glass, Teflon lined septum
Metals (42 + QA[7])	EPA SOW 1287[2]	Water	4°C, HNO_3 pH<2	180 days	1 L; polyethylene
Metals (135 + QA[7])	EPA SOW 1287[2]	Soil	4°C	180 days	8 oz glass
chloride (6 + QA[7])	EPA 325.2[4]	"WATER	none required	28 days	8 oz glass
oil & grease (6 + QA[7])	EPA 413.1[4]	"	4°C, H_2SO_2 pH<2	28 days	8 oz glass

Table 1 (con't)

Parameter/ (# of Samples)	Method Reference	Matrix	Sample Preservation	Holding Time	Sample Size; Container
sulfate (6 + QA[7])	EPA 375.4[4]	Soil WATER	4°C	28 days	8 oz glass
BOD (6 + QA[7])	EPA 405.1[4]	Water	4°C	48 hours	1 L; glass
TSS (6 + QA[7])	EPA 160.2[4]	"	4°C	7 days	1 L; glass
TDS (6 + QA[7])	EPA 160.1[4]	"	4°C	7 days	1 L; glass
COD (6 + QA[7])	EPA 410.4[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
alkalinity (6 + QA[7])	EPA 310.1[4]	"	4°C	14 days	1 L; glass
TOC (6 + QA[7])	EPA 415.1[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
hardness (6 + QA[7])	EPA 130.2[4]	"	4°C, HNO3 pH<2	6 months	1 L; glass
sulfate (6 + QA[7])	EPA 375.4	"	4°C, none	Do	1 L; glass
cation exchange capacity (12 + QA[7])	SW-846 9080/81[3]	Soil	none required		8 oz glass
VOC's in air (8 + QA[7])	NIOSH 1003[5]	Air	sealed tube	48-72 hrs	charcoal tube
Aroclor 1248 (8 + QA[7])	NIOSH 5503[6]	Air	sealed cartridge	2 months	glass fiber
Particulates (8 + QA[7])	NIOSH 0500[6]	Air	sealed cartridge		PVC filter

Table 1 (con't)

Parameter/ (# of Samples)	Method Reference	Matrix	Sample Preservation	Holding Time	Sample Size; Container
sulfate (6 + QA[7])	EPA 375.4[4]	Soil WATER	4°C	28 days	8 oz glass
BOD (6 + QA[7])	EPA 405.1[4]	Water	4°C	48 hours	1 L; glass
TSS (6 + QA[7])	EPA 160.2[4]	"	4°C	7 days	1 L; glass
TDS (6 + QA[7])	EPA 160.1[4]	"	4°C	7 days	1 L; glass
COD (6 + QA[7])	EPA 410.4[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
alkalinity (6 + QA[7])	EPA 310.1[4]	"	4°C	14 days	1 L; glass
TOC (6 + QA[7])	EPA 415.1[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
hardness (6 + QA[7])	EPA 130.2[4]	"	4°C, HNO3 pH<2	6 months	1 L; glass
sulfate (6 + QA[7])	EPA 375.4	"	4°C, none	Do	1 L; glass
cation exchange capacity (12 + QA[7])	SW-846 9080/81[3]	Soil	none required		8 oz glass
VOC's in air (8 + QA[7])	NIOSH 1003[5]	Air	sealed tube	48-72 hrs	charcoal tube
Aroclor 1248 (8 + QA[7])	NIOSH 5503[6]	Air	sealed cartridge	2 months	glass fiber
Particulates (8 + QA[7])	NIOSH 0500[6]	Air	sealed cartridge		PVC filter

Footnotes:

1. US EPA CLP Statement of Work for Organic Analysis 2/88.
2. US EPA CLP Statement of Work for Inorganic Analysis 12/87.
3. Test Methods for Evaluating Solid Waste (SW-846), Third Edition, Office of Solid Waste and Emergency Response, Nov. 1986.
4. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-20, Revised March 1983.
5. NIOSH Manual of Analytical Methods, 3rd Ed., US Dept. of Health, Education and Welfare, Publ. (NIOSH) 77-157-A (1984).
6. NIOSH Manual of Analytical Methods, 3rd Ed., Rev. 1.0, US Dept. of Health, Education and Welfare, Publ. (NIOSH) 77-157-A (1987).
7. QA samples will consist of the following, where applicable:
   Trip blanks, consisting of demonstrated analyte-free water sealed in 40 mL septum vials, will be taken into the field at a frequency of once per day when sampling for volatile organics in an aqueous matrix. They will be submitted for CLP TCL Volatile analysis.
   Field blanks will be collected once per day per piece of sampling equipment.
   Method blanks will be prepared and analyzed at a freguency of 1 in 20 for all CLP TCL analytes and metals.
   DI water blanks (demonstrated analyte free water) will be analyzed for the CLP TCL and metals.
   Field duplicates will be collected at a rate of 10% for soil and water (14 for soil and 5 for water) and will be submitted for the CLP TCL and metals analyses.

APPENDIX H

PROTOCOL FOR CLEANING GROUND-WATER
SAMPLING EQUIPMENT

1. Remove the dedicated Teflon-lined polyethylene tubing, wipe it down with tap water and store in a plastic bag.
2. Remove the dedicated Teflon bladder and store it with the tubing.
3. The only parts of the pump having contact with the sample are the pump barrel exterior, the bottom check valve and the tubing connector on top. These three items will be cleaned as follows.
4. Wash with detergent followed by a tap water rinse.
5. Rinse with 10 percent HNO_3 followed by a tap water rinse, (only if metals are being tested).
6. Rinse with acetone, (or methanol followed by hexane) followed by a deionized water rinse. The deionized water will be demonstrated analyte free. Copies of the laboratory analysis will be kept onsite for inspection during EPA audit.
7. Air dry.
8. Reassemble with new dedicated bladder and tubing.
9. Wrap with aluminum foil, shiny side out.

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APPENDIX I

SENTEXT SCENTOGRAPH GAS CHROMATOGRAPH/
ARGON IONIZATION DETECTOR

Detailed Calibration Procedures

Theory of Calibration: Gas chromatography is considered to be one of the most effective analytical techniques for analyzing gases and vapors. Its unique capabilities are:

1. High resolution - The ability to separate a mixture composed of different chemicals to a mixture composed of several hundred different vapors.
2. Identification - If accurate temperature control is used, separate chemicals can be identified with high accuracy.
3. Quantitation - Since the response of various detectors used in gas chromatography is proportional to the concentration levels of the chemicals detected, concentration levels of the chemicals can be measured.

However, none of the important features can be achieved without proper calibration. The section will deal with various methods of calibrations and those available for the Scentograph.

1. Calibration Methods for Identification Purposes

Identification in gas chromatography is based on the principle that at constant temperature and carrier gas flow conditions, the retention time of each vapor (the travel time from the time of injection to the time of detection) is constant. In order to identify certain vapors, a sample of a given vapor must be injected to the column and its retention time measured.

When an unknown sample is introduced to the column, and its retention time is measured and if its found to match the previous sample, the unknown sample is identified as the same chemical as previously injected. If, for example, benzene is to be analyzed, a sample of benzene is injected to the column and its retention time is measured. A sample of air can then be analyzed for the presence of benzene by the injection of a sample of air to the column and the measurement of the retention time (times) generated. If one retention time matches with that of benzene, it can be concluded that the sample of the air contained benzene. This is true, however, only if the two injections were carried out under the same conditions, This procedure can be repeated for a number of chemicals, in the same manner. Some factors should be considered when using this technique:

a. Since retention times depend on temperature and gas flow, the gas chromagraphic system must maintain constant gas flow through the column and must be accurately and evenly thermally controlled.

b. Retention time may vary slightly throughout the operation of the instrument, from day to day, and certainly for different columns (even of the same type). It is, therefore, essential to recalibrate (introduce new standards) before the start of analysis and, occasionally, during operation.

Two methods are available for calibration for identification purposes.

1-1. Direct Calibration

In the Direct Calibration method, a standard for each vapor to be detected is introduced to the column for retention time measurement. For example, if benzene, methylene chloride and

trichloroethylene are to be detected, a gas mixture containing certified concentration levels of these three gases should be introduced to the column.

The retention time for each one of the chemicals is established. When a sample to be analyzed is introduced to the column and "produces" several retention times, the retention times which match with the three retention times produced in the calibration cycle indicate the presence of one or more of those compounds in the analysis sample.

This method is the most accurate and acceptable method in gas chromatography. It simply states that in order to identify a certain compound the gas chromatograph should be calibrated with the same compound prior to the analysis.

The Scentograph has the capability of processing a mixture of up to 16 compounds for direct calibration purposes. During calibration, the instrument will record all retention times and assign a compound name to each retention time. During analysis, the instrument will match the retention time obtained with those recorded during calibration and identify those compounds which match. The Scentograph, also, contains the ability to adjust the retention time window, that is the range in which a retention time match will occur and a compound will be identified.

1-2. Calculated Calibration

This method is based on the assumption that the ratio between retention times of different compounds is a constant value. Therefore, if for

a particular column, retention time for M.E.K. is 70 seconds and the retention time of benzene is 150 seconds, the ratio between them will be maintained even if column conditions (flow and temperature) are changed. Hence if retention time for M.E.K. at higher temperature changes to 35 seconds, that of the benzene changes to 75 seconds.

This principle allows the establishment of a procedure to identify unknown compounds based on calibration with a single compound.

Retention times for several compounds for a certain column have to be established and their ratio is to be calculated. If benzene, for example, is the calibration compound, the relative retention time (RRT) of M.E.K. will be:

$$RRT = \frac{70}{150}$$

If RT of benzene is 150 and RT for M.E.K. is 70.

Therefore, the retention times for various compounds must be measured relative to benzene and then its RRT be established, as follows:

Compound	RT	RRT
Benzene	150	1
Toluene	174	$\frac{174}{150} = 1.16$
ETO	59	$\frac{59}{150} = .393$

Compound	RT	RRT
M-Xylene	220	$\frac{220}{150} = 1.47$
O-Xylene	270	$\frac{270}{150} = 1.8$

For calibration purposes, prior to the analysis, only benzene is injected for measurement of its retention time. Once the value is established, other retention times can be calculated as above.

This method, however, has some distinct disadvantages such as:

a. The ratio of retention times may not be constant with substantial column condition changes.

b. The ratio varies for each column, even of the same type.

c. The ratio may change with the lifetime of a particular column. Therefore, this calibration method is not as accurate as the direct calibration method. It is used, primarily, when screening for unknown compounds are required and the direct calibration method cannot be applied. Once a compound is identified by this method, it is essential that direct calibration will be subsequently carried out for accurate identification.

2. Calibration Methods for Quantitation Purposes

There are three methods of quantitation in gas chromatography - all based on the assumption that area under a peak represents the concentration of the chemical and is proportional to the concentration.

The quantitation methods are:

a. Multipoint Calibration Method

This method, which is the most accurate, is applied as follows:

Different concentration levels of a chemical are introduced to the gas chromatograph and a curve which indicates the peak areas (horizontal axis) versus the concentration level (vertical axis) is plotted. When an unknown concentration of the same chemical is injected into the system, the area obtained is placed on the curve to derive the concentration level.

This method is very accurate and can cover a large range of concentration. For example, if accurate range of both parts per billion (ppb) levels and parts per million (ppm) levels are required to be detected, a curve consisting of the following concentrations

1, 5, 10, 10, 50, 100, 200, 500 ppb

and

1, 5, 10, 20, 50 ppm

versus

their corresponding area derived from their analysis is drawn.

This will assure that quantitations at those levels is accurate as possible. However, this method is very cumbersome, time consuming, and

applicable to one chemical at a time. Therefore, it is only used when a specific requirement exists.

b. Two Point Calibration Method

This method is sufficiently accurate for most applications and is the most commonly used in gas chromatography. Its accuracy, within a certain concentration level is satisfactory, while its operation is relatively easy.

A calibration curve, similar to the previous one, is drawn, using two points only. One is zero with an assumed area count of zero and the other point consists of the area count obtained when a known concentration of the standard is injected, versus its concentration level.

If concentration levels between 0 and, for example, 2 ppm are required to be detected, a standard of 1 ppm is recommended to be used, and a curve consisting of 2 points, 0/0 and area for 1 ppm be established.

Low ppb levels (1-50) and high ppm levels (10-50) may be detected in this method (using 1 ppm standard) with less accuracy, but the method is sufficiently accurate for .1 ppm to 5 ppm range of concentration.

The method, therefore, is relatively simple and requires one concentration for calibration. Also, several chemicals can be calibrated at one time.

c. Calculated Quantification

The calculation quantification method is the least accurate method and should be used only in cases where other methods cannot be used.

This method is based on the assumption that the ratio of a detector response for two or more chemicals is constant.

Suppose an area count for 1 ppm of benzene in a calibration run is 10,000 counts, and the area count for 1 ppm of ethylene oxide is 5,000 counts, it is assumed that the count ratio will remain constant.

Therefore, if the gas chromatograph is calibrated with 1 ppm of benzene, and during the analysis a peak of which the retention time is calculated to be ethylene oxide is obtained, the instrument will first identify the peak as ethylene oxide (see calculated calibration method of identification).

The peak area is counted and compared with that of the calibrated benzene. If the area is one-half of that calibration ethylene oxide will be measured at 1 ppm. If the area count is twice the area of benzene, the ethylene oxide will be calculated to be 4 ppm.

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APPENDIX J

GEONICS LIMITED EM-31 TERRAIN CONDUCTIVITY METER

Operating Instructions

A. Using the identifying labels on the tubes align the transmitter coil tube with respect to the main tube and fix it with the clamp.

B. Check battery condition, plus and minus, by setting the mode switch to the "OPER" position and the range switch to the "+B" and "-B" positions respectively. If needle reads inside the "BATT" mark on the meter, batteries are in good condition, otherwise replace the batteries with a fresh set of "C" size alkaline batteries.

C. Electronic nulling of the instrument, if necessary, is done by setting the Mode switch to the "OPER" position, setting the range switch to the least sensitive position (1,000 millimhos per meter), and then adjusting the "NULL" control to obtain zero reading.

D. Align and connect the receiver coil tube to the main tube. Ensure that the mode switch is set to the "OPER" position.

E. Wearing the instrument with the shoulder strap adjusted so that the instrument rests comfortably on the hip, switch the Mode switch to the "OPER" position and rotate the range switch so that the meter reads in the upper two-thirds of the scale. The full-scale deflection is now indicated by the range switch and the instrument is reading the terrain conductivity directly in millimhos per meter.

F. In moving to the next measurement station, the MODE switch may be left in the "OPER" position to provide a continuous reading of the terrain conductivity. The

instrument has a time constant of approximately one second to which the operator should adjust his walking speed for the greatest accuracy.

Equipment Functional Checks

The functional checks shall be performed once, at the beginning of the project. A daily check is not necessary. The functional checks are normally carried out over ground of conductivity less than 30 millimhos per meter.

A. Set the instrument for normal operation as indicated in the operating instructions.

Put the range switch to the 30 position for all the following tests. Set the Mode switch to the "COMP" position, and adjust the meter needle to read zero using the "COARSE" switch and the "FINE" compensation potentiometer.

B. To check the phasing of the instrument set the mode switch to the "PHASE" position. Rotate the "COARSE" switch clockwise one step.

If there is a change in the reading adjust the "PHASE" potentiometer until there is no change in the reading for the one step change in the "COARSE" control setting.

Check that the "COARSE" switch has been left in its original position by switching the mode switch to the "COMP" position as for (A) above and insuring that the meter still reads zero.

C. To approximately check the sensitivity of the instrument set the mode switch to the "COMP" position, and rotate the "COARSE" switch clock-wise for one step. Needle should deflect for about 75 percent to 85 percent of full scale (inside black mark) reading. It is unlikely that the sensitivity of the instrument will vary, however, it may be

useful to record the actual meter reading for comparison at a later date.

D. For ground of conductivity higher than 30 millimhos per meter, the functional checks should be carried out with the range switch set at the position corresponding to the conductivity of the ground over which the functional checking is performed.

In such a case the needle deflection indicated in Section 3.1c and 3.1d should still be 22 to 26 millimhos per meter (which will now be a smaller percentage of the full-scale deflection).

EM-31 RECORDER

1. Complete the EM-31 functional checks as described in Section 3.1 of the EM-31 Operating Manual.

2. With recorder on, and connected to the EM-31 but with the EM-31 off, rotate the position knob of the recorder setting the pen at the Zero position at the left-hand side on the chart paper.

3. Set the recorder sensitivity (Range Switch) to 500 mv.

4. Turn the EM-31 on and set the EM-31 Range Switch to 10, 100 or 1,000 millimhos per meter whichever gives the largest meter deflection in location at hand (e.g., for an apparent conductivity of 28 millimhos per meter the Range Switch on the EM-31 would be set at 100 millimhos per meter.

5. Using the Vernier adjustment, set the pen position to read the same number of divisions (to the right of the Zero position) as the EM-31 meter reading in millimhos per meter (ms/m).

6. The full-scale deflection on the chart paper will not correspond to full-scale deflection of the EM-31 meter.

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APPENDIX K

PROTOCOL FOR SOIL SAMPLING

Equipment:

Split-spoon samplers
Polyethlene sheeting
Table (optional)
Surgical gloves (or equivalent) and Solvex gloves

Procedure:

1. Assemble the 3-inch diameter rust-free carbon steel Lynex, or equivalent, split-spoon sampler when all parts have been cleaned.
2. Transfer the sampler to the driller (or helper); be sure that this person has clean gloves on.
3. The sample will then be collected by the driller using the standard penetration test.
4. Obtain the sampler from the driller and place it on polyethylene sheeting.
5. Unscrew the end cap and break the spoon open to expose the sample.
6. Using only the spatula, cut off the top 2 to 3 inches of sample and discard, and transfer an appropriate portion to the sample container for volatile organic analysis. Fill the container as completely as possible. If the sample is from a predetermined depth requiring analysis, homogenize the sample using a stainless steel pan and a stainless steel spatula. Where appropriate because of sample cohesiveness use the coning and quartering method of homogenization. Put the sample in the appropriate containers. If the sample is to be screened, remove a small portion and conduct the screening as specified in Appendix C, making sure the split spoon is closed. If the

screening results in readings above 5 ppm, immediately transfer some of the sample to volatile vials. Homogenize the remainder and put it in the appropriate containers. If, for some reason, a decision cannot be reached within 5 minutes, immediately fill two vials so that the decision can be postponed.

7. Fill out the sample label (project, location, depth, date, etc.) and cover with transparent tape. Place the container in a cooler with ice.
8. Fill out sample/core log and chain-of-custody form.
9. Deliver sample to the shipping courier and obtain airbill number for the chain-of-custody. Samples will be sent via overnight courier to the receiving laboratory for analysis.

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APPENDIX L

PROTOCOL FOR CLEANING SOIL SAMPLING EQUIPMENT

1. With a dedicated wire brush, clean out any solid material remaining in or on the sampling equipment.
2. Place all sampling equipment on a grate with a catchment drum beneath it.
3. Wash with detergent and tap water.
4. Rinse with tap water
5. Rinse with 10 percent HNO_3 (or 1 percent HNO_3 if the sampling equipment is made of carbon steel) (if used for metal sampling).
6. Rinse with tap water.
7. Rinse with acetone (or methanol, followed by hexane).
8. Rinse with deionized water. The deionized water will be demonstrated analyte free. Copies of the laboratory analysis will be kept onsite for inspections during EPA audit.
9. Air dry.
10. Reassemble all sampling equipment with gloved hands.
11. Wrap in aluminum foil, shiny side out.

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APPENDIX M

STANDARD OPERATING PROCEDURE FOR
SENSIDYNE GAS DETECTOR

1. Choose a detector tube for desired compound.

2. Break tips of a fresh detector tube by bending each tube end in the tip breaker located on the pump housing.

3. Insert the tube securely into the rubber inlet of the pump with arrow on the tube pointing toward the pump.

4. Make certain the pump handle is all the way in. Align the guide marks on the shaft and the housing pump.

5. Pull the handle all the way out until it locks on one (1) pump stroke (100 ml). The stroke pull duration should be one (1) minute. Repeat this sampling procedure for recommended strokes per detector tube.

6. Read concentration at the interface of the stained-to-unstained reagent when staining stops after completion of recommended strokes.

7. The sampling procedure and interpretation varies depending on the tube utilized. The instructions provided with the tubes should be reviewed prior to use.

One of the tubes that will be used at the site is a vinyl chloride detector tube. This tube has a detection

range of 0.01 ppm to 8.8 ppm which is dependent upon the strokes. For example:

Strokes	Range
7	0.1 - 1.0 ppm
4	0.2 - 4.0 ppm
2	4.0 - 8.8 ppm

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APPENDIX N

Short Form

Work/QA Plan Short Form

Title Page

RI/FS at Occidental Chemical Corp.
Hooker/Ruco Site
(Project Name)

Occidental Chemical Corporation
(Responsible Agency)

(Project Officer's Signature) Timothy Yagley

(Project Officer's Name) Timothy J. Yagley

(Project Quality Assurance Officer's Signature) William Leroux

(Project Quality Assurance Officer's Name) William Leroux

1. **Project:** Hooker/Ruco RI/FS

2. **Project Requested By:** US EPA

3. **Date of Request:** N/A

4. **Date of Project Initiation:** N/A

5. **Project Officer:** (QA Program Manager) Tim Yagley

6. **Quality Assurance Officer:** William Leroux

7. **Project Description:**

A. **Objective and Scope Statement:** To collect analytical data from groundwater, surface water and surface and subsurface soils, performed pursuant to Section 122(c) of CERCLA, 42 U.S.C. §9622(e).

B. **Data Usage:** To define the presence, magnitude and extent of any hazardous wastes and hazardous constituents not already defined, within and beyond the facility boundaries.

C. **Monitoring Network Design and Rationale:** Forty-two monitoring wells will be installed and/or developed. The wells will be sampled analyzed to determine the presence or absence of the chemical parameters listed in E.

D. **Monitoring Parameters and their Frequency of Collection:** See E. for parameters; this will be a single event sampling.

E. Parameter Table

Parameter	Number of Samples	Sample Matrix	Analytical Method Reference*	Sample Preservation	Holding Time	Containe
		See attached table 1				

* if other than EPA, must be attached

F. QA Sample Parameter Table

	Parameter	Number of Samples	Sample Matrix	Analytical Method Reference*	Sample Preservation	Holding Time	Containers
Field Blank	all as above	10%	all as above				
Field Split	"	10%	all as above				
Lab Duplicate	"	10%	all as above				

* if other than EPA, must be attached

8. Project Fiscal Information (Optional):

A. Survey Costs N/A

Salaries _____

Supplies _____

Equipment _____

Mileage _____

B. Laboratory Services _____

C. Administrative Overhead _____

D. Consultant Services _____

Total Project Costs _____

9. Schedule of Tasks and Products

Activity/Date						

reference FOP for schedule

Data Representatives: As a goal, individual samples are to be representative of the location from which they are collected, and analyses will be representative of the sample.

Data Comparability: Data will be generated and reported in units consistent with the requirements of the referenced methods.

Data Completeness: All valid data points will be reported.

12. **Sampling Procedures:** Groundwater collected with teflon bladder pump with dedicated teflon lined polyethylene tubing. Soil: split-spoon.

13. **Sample Custody Procedures:** Sample custody will follow LBG/OCC procedure which meets the requirements of EPA SW846.

14. **Calibration Procedures and Preventive Maintenance:** In Laboratory: As specified in the methodology.

15. **Documentation, Data Reduction, and Reporting**

A. **Objective and Scope Statement:** Data sheets, field logs, photographs and chain of custody will be kept by all applicable personnel until the project is closed.

B. **Data Usage:** The designated laboratory will calculate and report the data to the OCC Site Coordinator, who will transmit the data to the EPA.

16. **Data Validation:** The OCC Quality Assurance Officer (QAO) will evaluate the data based on surrogate recoveries, detection limits, instrument standards and evaluation of chromatograms. The QAO will determine precision and accuracy and utilize the QA criteria set forth in the methodology of the analysis to validate the data.

17. **Performance and Systems Audits:** Audits will be conducted in accordance with Section 4.0 of FOP.

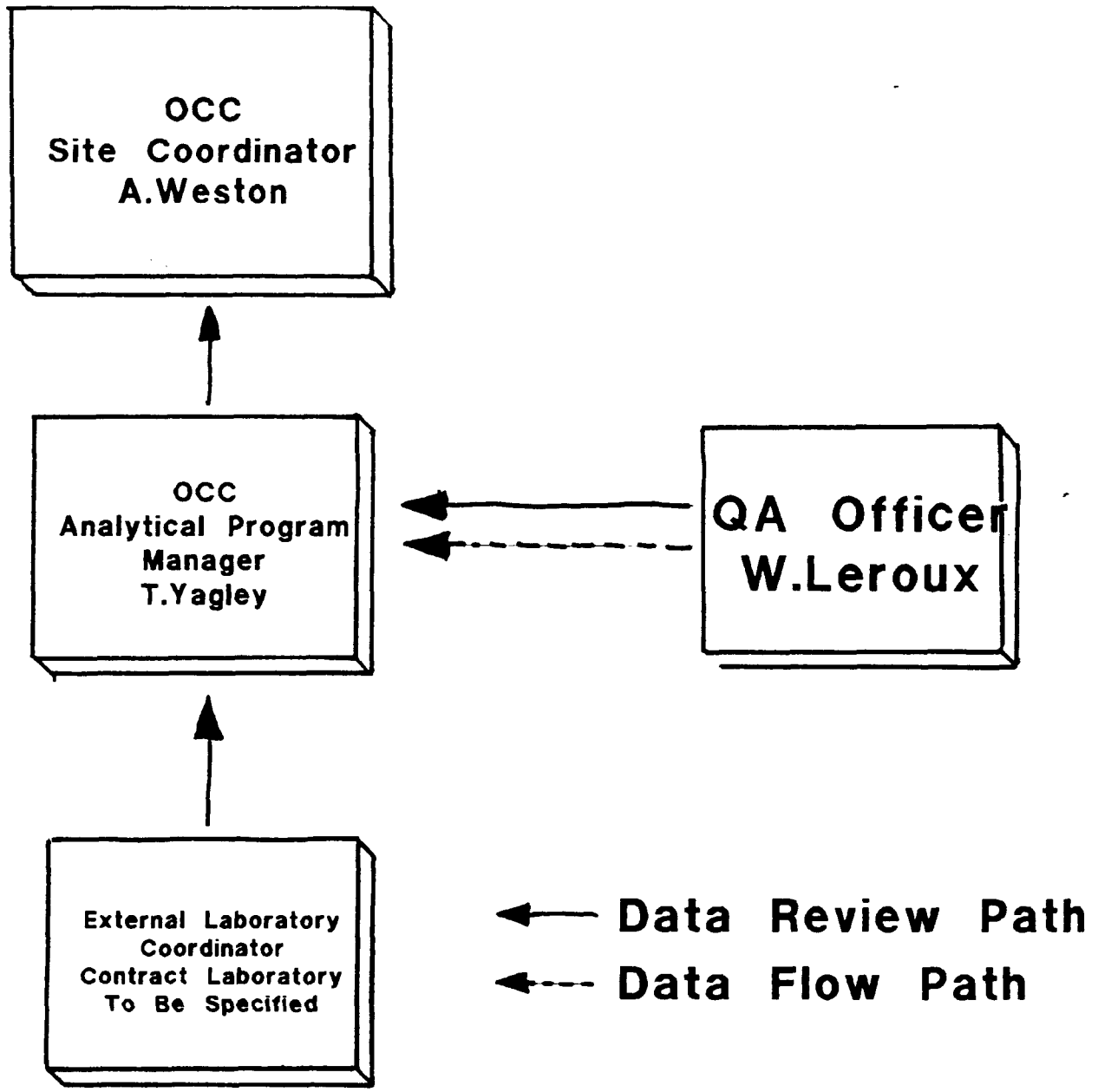
18. **Corrective Action:** Corrective Actions will be conducted in accordance with Section 4.0 FOP

19. **Reports:** The final output of the project will be a sampling and analysis report. The report shall include the following: a) Map of sample locations, b) Sample ID numbers, c) sample analysis information, d) sample analysis results, e) QA/QC Data, f) QA/QC Review, g) Assessment of the Data.

FIGURE 1

QA Project Organization

Hooker/Ruco Site



Distribution of Analysis

Parameter/Method	Laboratory
pH	Field (LGB)
Conductivity	Field (LGB)
Temperature	Field (LGB)
TOC	Radian Corporation
TCL	"
Metals	"
ARAR's	"
MOCA	"
BOD, TSS, TDS	"
COD, alkalinity,	"
hardness, chloride,	"
sulfate, oil & grease	"
cation exchange capacity	"
VOA's in Air	NATLSCO
Aroclor 1248 on Particulates	"
Particulates	"

Table 1

Parameter/ (# of Samples)	Method Reference	Matrix	Sample Preservation	Holding Time	Sample Size; Container
TCL Semi-VOA's & MOCA (135 + QA[7])	EPA SOW 288[1] (MOCA method attached)	Soil	4°C	extract in 10 days, analyze in 40 days	8 oz glass
TCL Pest/PCB's (135 + QA[7])	EPA SOW 288[1]	Soil	4°C	extract in 10 days, analyze in 40 days	8 oz glass
TCL VOA's (135 + QA[7])	EPA SOW 288[1]	Soil	4°C	analyze in 10 days	2 x 40 mL glass, Teflon lined septum
TCL Semi-VOA's & MOCA (42 + QA[7])	EPA SOW 288[1] (MOCA method attached)	Water	4°C	extract in 5 days, analyze in 40 days	1 liter; glass
TCL Pest/PCB's (42 + QA[7])	EPA SOW 288[1]	Water	4°C	extract in 5 days, analyze in 40 days	1 liter; glass
TCL VOA's (42 + QA[7])	EPA 524.2	Water	pH<2 1:1 HCl	analyze in 10 days of receipt	2 x 40 mL glass, Teflon lined septum
Metals (42 + QA[7])	EPA SOW 1287[2]	Water	4°C, HNO_3 pH<2	180 days	1 L; polyethylene
Metals (135 + QA[7])	EPA SOW 1287[2]	Soil	4°C	180 days	8 oz glass
chloride (6 + QA[7])	EPA 325.2[4]	"	none required	28 days	8 oz glass
oil & grease (6 + QA[7])	EPA 413.1[4]	"	4°C, H_2SO_2 pH<2	28 days	8 oz glass

Ta 1 (con't)

Parameter/ (# of Samples)	Method Reference	Matrix	Sample Preservation	Holding Time	Sample Size; Container
sulfate (6 + QA[7])	EPA 375.4[4]	Soil	4°C	28 days	8 oz glass
BOD (6 + QA[7])	EPA 405.1[4]	Water	4°C	48 hours	1 L; glass
TSS (6 + QA[7])	EPA 160.2[4]	"	4°C	7 days	1 L; glass
TDS (6 + QA[7])	EPA 160.1[4]	"	4°C	7 days	1 L; glass
COD (6 + QA[7])	EPA 410.4[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
alkalinity (6 + QA[7])	EPA 310.1[4]	"	4°C	14 days	1 L; glass
TOC (6 + QA[7])	EPA 415.1[4]	"	4°C, H2SO4 pH<2	28 days	1 L; glass
hardness (6 + QA[7])	EPA 130.2[4]	"	4°C, HNO3 pH<2	6 months	1 L; glass
sulfate (6 + QA[7])	EPA 375.4	"	4°C, none	Do	1 L; glass
cation (12 + QA[7]) exchange capacity	SW-846 9080/81[3]	Soil	none required		8 oz glass
VOC's in air (8 + QA[7])	NIOSH 1003[5]	Air	sealed tube	48-72 hrs	charcoal tube
Aroclor 1248 (8 + QA[7])	NIOSH 5503[6]	Air	sealed cartridge	2 months	glass fiber
Particulates (8 + QA[7])	NIOSH 0500[6]	Air	sealed cartridge		PVC filter

Fo ·tes:

1. US EPA CLP Statement of Work for Organic Analysis 2/88.
2. US EPA CLP Statement of Work for Inorganic Analysis 12/87.
3. Test Methods for Evaluating Solid Waste (SW-846), Third Edition, Office of Solid Waste and Emergency Response, Nov. 1986.
4. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-20, Revised March 1983.
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7. QA samples will consist of the following, where applicable:
   Trip blanks, consisting of demonstrated analyte-free water sealed in 40 mL septum vials, will be taken into the field at a frequency of once per day when sampling for volatile organics in an aqueous matrix. They will be submitted for CLP TCL Volatile analysis.
   Field blanks will be collected once per day per piece of sampling equipment.
   Method blanks will be prepared and analyzed at a freguency of 1 in 20 for all CLP TCL analytes and metals.
   DI water blanks (demonstrated analyte free water) will be analyzed for the CLP TCL and metals.
   Field duplicates will be collected at a rate of 10% for soil and water (14 for soil and 5 for water) and will be submitted for the CLP TCL and metals analyses.

Hicksville/Ruco Data Quality Requirements and Assessments
Table 2

Parameter	Method Reference	Matrix	Precision/Accuracy Objectives (% recovery + RSD)	% Completeness
pH	EPA 150.1	Water	per method	95
Conductivity	EPA 120.1	Water	per method	95
Temperature	EPA 170.1	Water	per method	95
TOC	EPA 415.1	Water	per method	95
TCL	EPA SOW 288	Soil/Water	per method	95
MOCA	attached	Soil/Water	per method	95
VOC's	EPA 524.2	Water	per method	95
Metals	EPA SOW 1287	Soil/Water	per method	95
VOA's	NIOSH 1003	Air	per method	95
Aroclor 1248	NIOSH 5503	Particulates	per method	95
Particulates	NIOSH 0500	Air	per method	95
BOD	EPA 405.1	Water	per method	95
TSS	EPA 160.2	Water	per method	95
TDS	EPA 160.1	Water	per method	95
COD	EPA 410.4	Water	per method	95
alkalinity	EPA 310.1	Water	per method	95
hardness	EPA 130.2	Water	per method	95
chloride	EPA 325.2	Water	per method	95
sulfate	EPA 375.4	Water	per method	95
oil & grease	EPA 413.1	Water	per method	95
cation exchange capacity	SW846-9080	Soil	per method	95

Occidental Chemical Corporation
Research Center

MEMO

To A. F. Weston **Date** September 29, 1982

From N. Simon

Subject GC/MS Analysis of Styrene, Moca, Phthalates and Five Volatile Organics

COPIES: D. Johnson, P. Skotnicki, R. Badger, TIC

I. SUMMARY

The EPA Priority Pollutant Method for base neutral organics was extended to include styrene and 3',3'-dichloro 4,4'-diamino diphenyl methane (MOCA). Standard curves were generated and extraction efficiencies calculated. Detection limits were set at 10 µg/L for styrene and 25 µg/L moca. The volatiles analyses could also be used to analyze for styrene and appears to be the preferred method.

A. Extractables

1). Instrumental Parameters

Gas Chromatographic Conditions (Finnigan 96100)

Column		- 15 m DB5-NB fused silica capillary (J&W)
Carrier		- Helium 15.0 psi
Injector Temperature		- 275°C
Injection		- Grob, 60/1 split after 60 seconds
Detector Temperature		- 275°C
GC/MS Interface		- 265°-275°C
Column Program	1)	- 20° to 250° at 10°/minute after a 1 minute hold at 20°, hold at 250° for 20 minutes.
	2)	- Without styrene - 50° to 250°.

Mass Spectrometer Conditions (Finnigan 4000)

Instrument	- Finnigan 4000 GC/MS interfaced with an Incos Data Acquisition System
Source Parameters	- 85°, Electron Impact Source with 70eV ionizing electrons
EM Volts	- 1380 volts
Scan Parameters	- Total scan sequence - .5 second consisting of acquisition during .45 second up scan, .05 second hold at bottom. Mass range scanned 350-45.

2). Sample Preparation

for the base neutral extraction, one liter of sample was adjusted to pH 11 with 6N NaOH; extracted three times with methylene chloride according to EPA protocol; dried through a sodium sulfate column; and concentrated to 5 ml using a Kuderna-Danish evaporator and nitrogen.

An internal standard, deuterated phenanthrene was added 15 minutes prior to the analysis.

3). Standard Preparation

A stock solution containing the six phthalates was purchased from Supelco. Styrene and MOCA standards were prepared in-house. The standards were prepared to give 1,5,10 and 20 times the detection limit. The detection limit for MOCA was set at 25 µg/L to give a relatively equivalent response when compared to styrene and the phthalates at 10 µg/L.

4). Extraction Efficiencies

Since the method has routinely been used for phthalates it was only necessary to verify its efficiency for styrene and MOCA. Three blank water samples were piked at 10X the detection limit, extracted and analyzed by the method noted above.

	% Recovery			
	Styrene		MOCA	
Sample	Day 1	Day 2	Day 1	Day 2
20832	51	55	72	88
20833	74	60	79	85
20834	88	74	69	83

The ions used to identify and quantitate were m/e 266, 268, and 131 for MOCA, and m/e 104, 102, 51 for styrene.

(B). VOLATILES

Extending Method 624 to include styrene.

(see Page 3 for Volatiles)

(B). VOLATILES

1) Instrumental Parameters

Purge and Trap Conditions
(Tekmar Liquid Sample Concentrator-Model LSC-2)

Plumbing	- Hard plumbed from trap effluent to the GC flow controller via a 1/8 inch O.D. copper line
Trap Column	- 12" x 1/4" stainless steel tubing packed with Tenax 60/80 mesh. Baked after each run at 250° for 20+ min.
Purge	- 12 minutes at 30 cc/minute
Desorb	- 4 minutes at 195°C
Sample Size	- 5 ml transferred by Blenco gas/liquid syringe

Gas Chromatographic Conditions (Finnigan 9610)

Column	- 8 foot by 1/4 inch (2mm I.D.) glass packed with 0.1% SP-1000 on Carbopack C
Carrier	- Helium at 30 cc/minute
Injector	- 180°C
GC/MS Interface	- 250°
Column Program	- 50° for purge, desorb and three minutes after desorb, 8°/min. to 180°; held for 30 min. at 180°

Mass Spectrometer Conditions

Instrument	- Finnigan 4000 GC/MS interfaced with an Incos Data Acquisition System
Source Parameters	- 260°, Electron Impact Source with 70 eV ionizing electrons
Manifold Temperature	- 90°
Electron Multiplier	- 1080 volts
Scan Parameters	- Total scan sequence of 2 seconds consisting of data acquisition during 1.95 sec. up scan, 0.05 sec. hold at bottom. Mass range scanned 45-270.

2. Standards

The standards used were supplied by Supelco and are described as "Standards for EPA Consent Decree Protocol". They are further referenced to (I.F.B. No. WA77-B133, Appendix B, Sampling and Analysis for Priority Pollutants, US EPA). A solution of styrene at the same concentration as the above standards, was prepared in the lab.

Bromochloromethane, 2-Bromo-1-chloropropene and 1,4-dichlorobutane were used as internal standards.

The stock solutions, as received from Supelco, were stored in a freezer. Dilutions were stored in the refrigerator in 15 ml hypovials until one hour before analysis. Standards were prepared to give concentration levels of 10 µg/L (50 ng injected) and 100 µg/L (500 ng injected). An additional standard at 25 µg/L (125 ng injected) was analyzed to verify linearity. Internal standards were prepared at 20 µg/L; 5 µl (100 ng injected) was used to spike each standard and sample.

Standards were stored in the refrigerator until one hour before analysis.

Standards were poured into a 5 ml syringe; the volume adjusted; the needle removed and 5 µl internal standard added immediately before injection into the Tekmar.

Standards could be prepared by weighing pure materials into methanol instead of using the commercial mix since only five of the priority pollutants are required: perchloroethylene, trichloroethylene, trans-1,2-dichloroethylene, toluene, and vinyl chloride. It should also be noted that the required detection limit for VCM is 5 µg/L while the detection limit for the other volatile components is 10 µg/L.

3. Results and Discussion

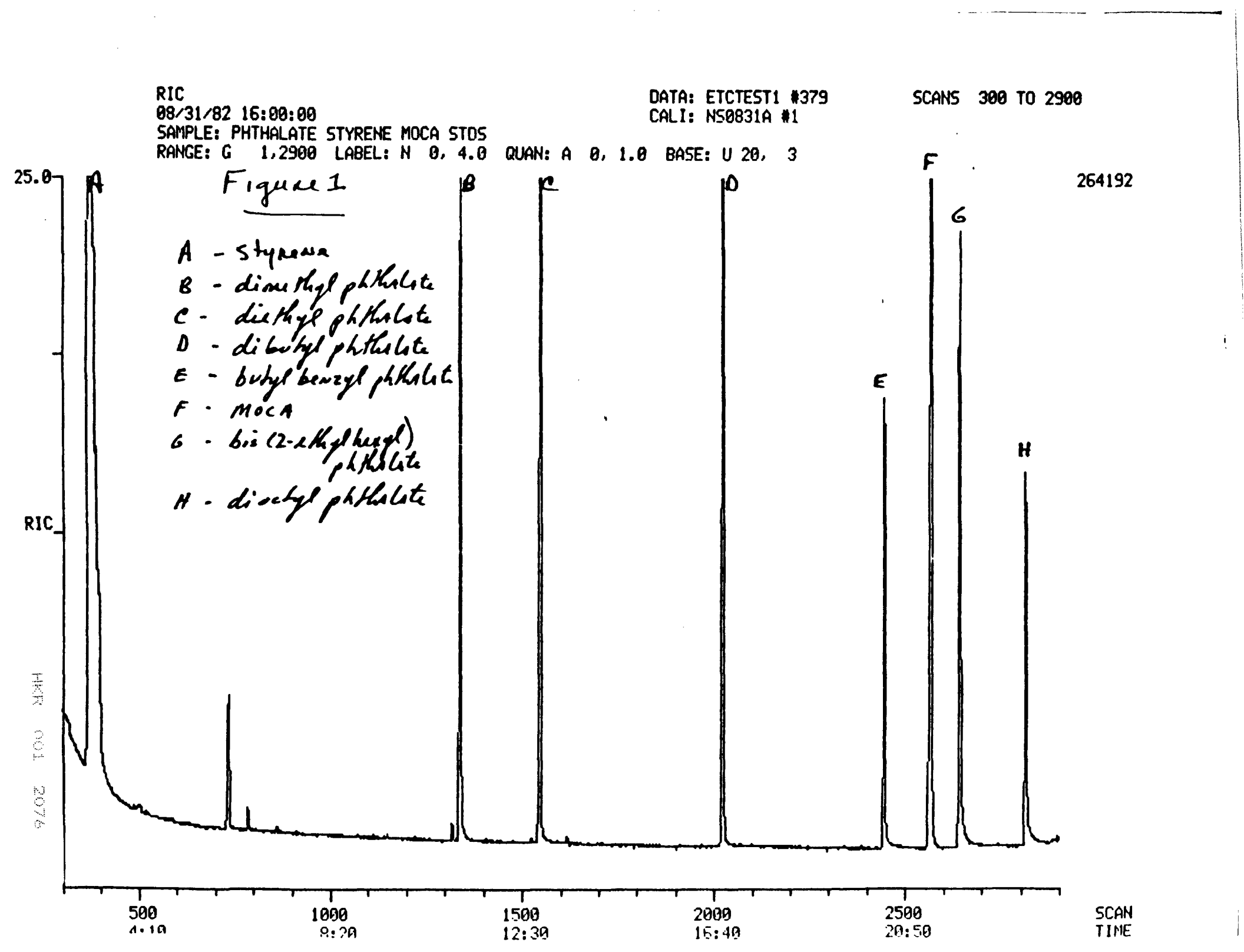
The EPA Priority Pollutant base neutral method can be extended to include styrene and MOCA. The chromatogram following (Figure 1) demonstrates the relative retention times of styrene and MOCA compared to the phthalates.

It seems preferable to analyze styrene with the volatiles rather than the extractables for a number of reasons: The gas chromatographic oven will not need subambient conditions to separate styrene from the solvent (see Figure 2); loss of styrene will not be a problem; a narrower range of internal standards will be acceptable, styrene carryover will be limited in the volatiles analysis, etc.

The RIC's from the analyses (Figures 1,2,4) and the mass spectrum of MOCA (Figure 3) follow.

Nan Simon
Central Sciences

jmw/


RIC
08/31/82 16:00:00
SAMPLE: PHTHALATE STYRENE MOCA STDS
RANGE: G 1,2900 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: ETCTEST1 #379
CALI: NS0831A #1
SCANS 300 TO 2900
Figure 1
A - Styrene
B - dimethyl phthalate
C - diethyl phthalate
D - dibutyl phthalate
E - butyl benzyl phthalate
F - MOCA
G - bis (2-ethylhexyl) phthalate
H - dioctyl phthalate
25.0
264192
RIC
A
B
C
D
E
F
G
H
500
4:10
1000
8:20
1500
12:30
2000
16:40
2500
20:50
SCAN
TIME

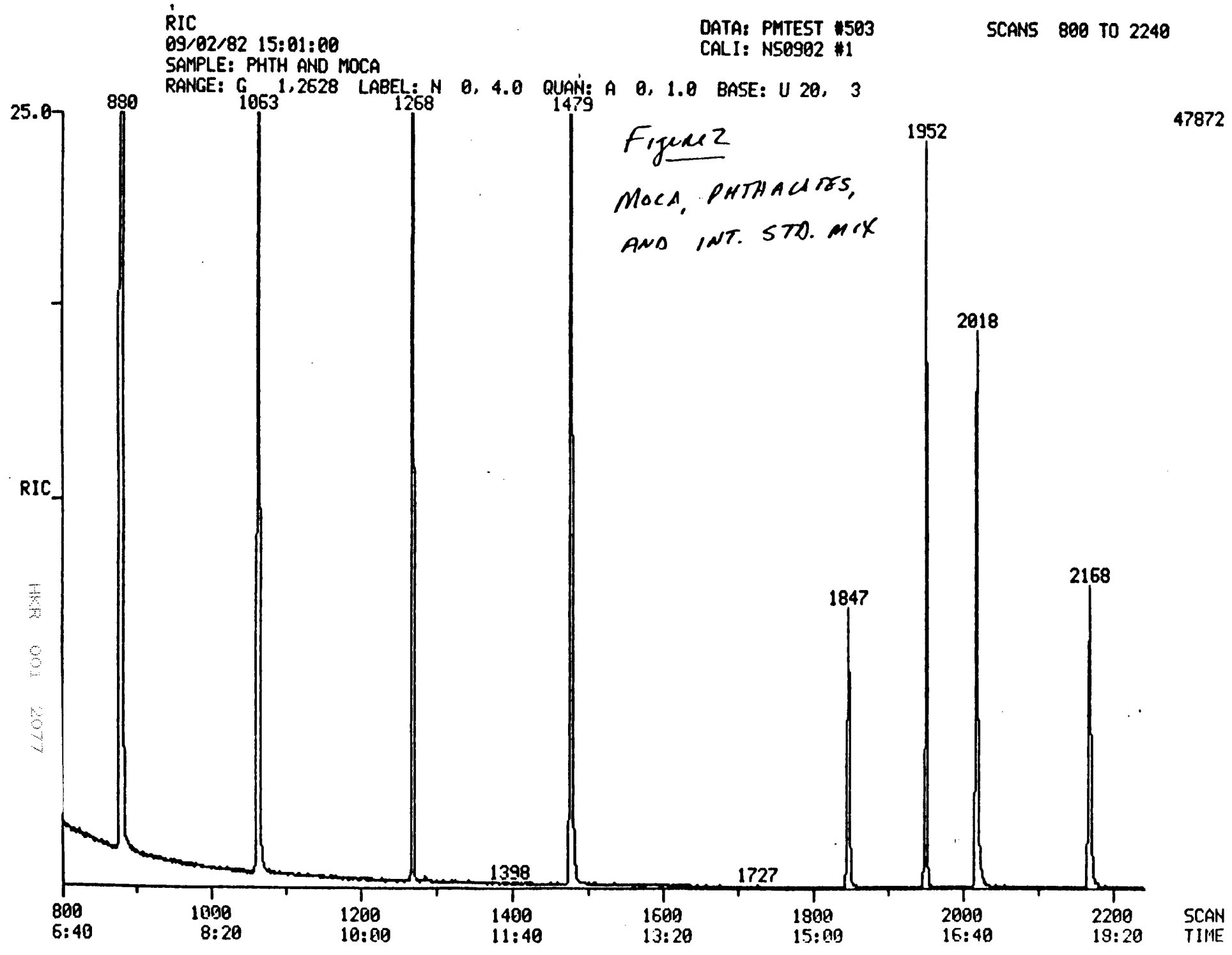


Figure 2

MOCA, PHTHALATES, AND INT. STD. MIX

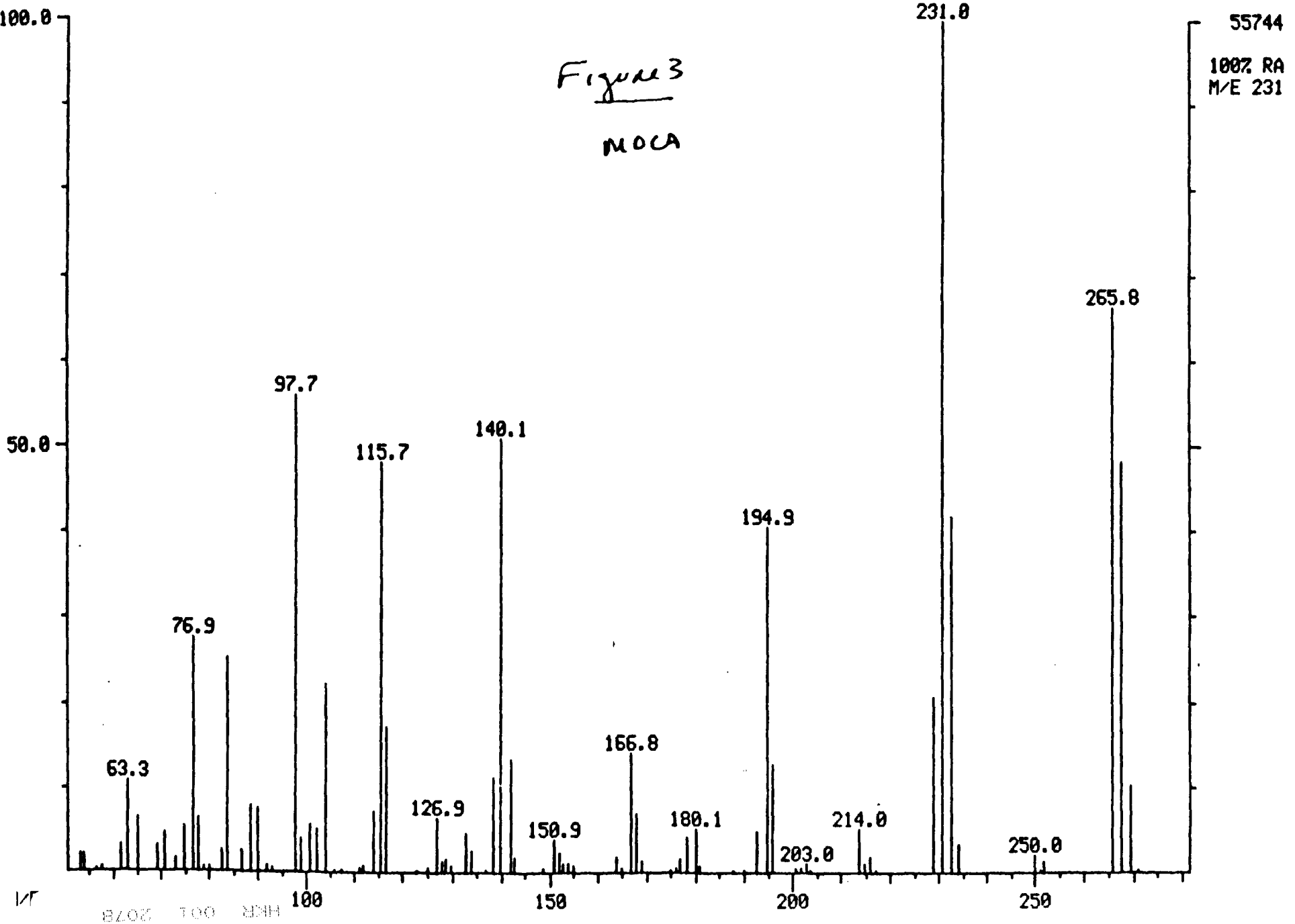
MASS SPECTRUM
08/31/82 15:22:00 + 21:27
SAMPLE: PHTHALATE STYRENE MOCA STDS

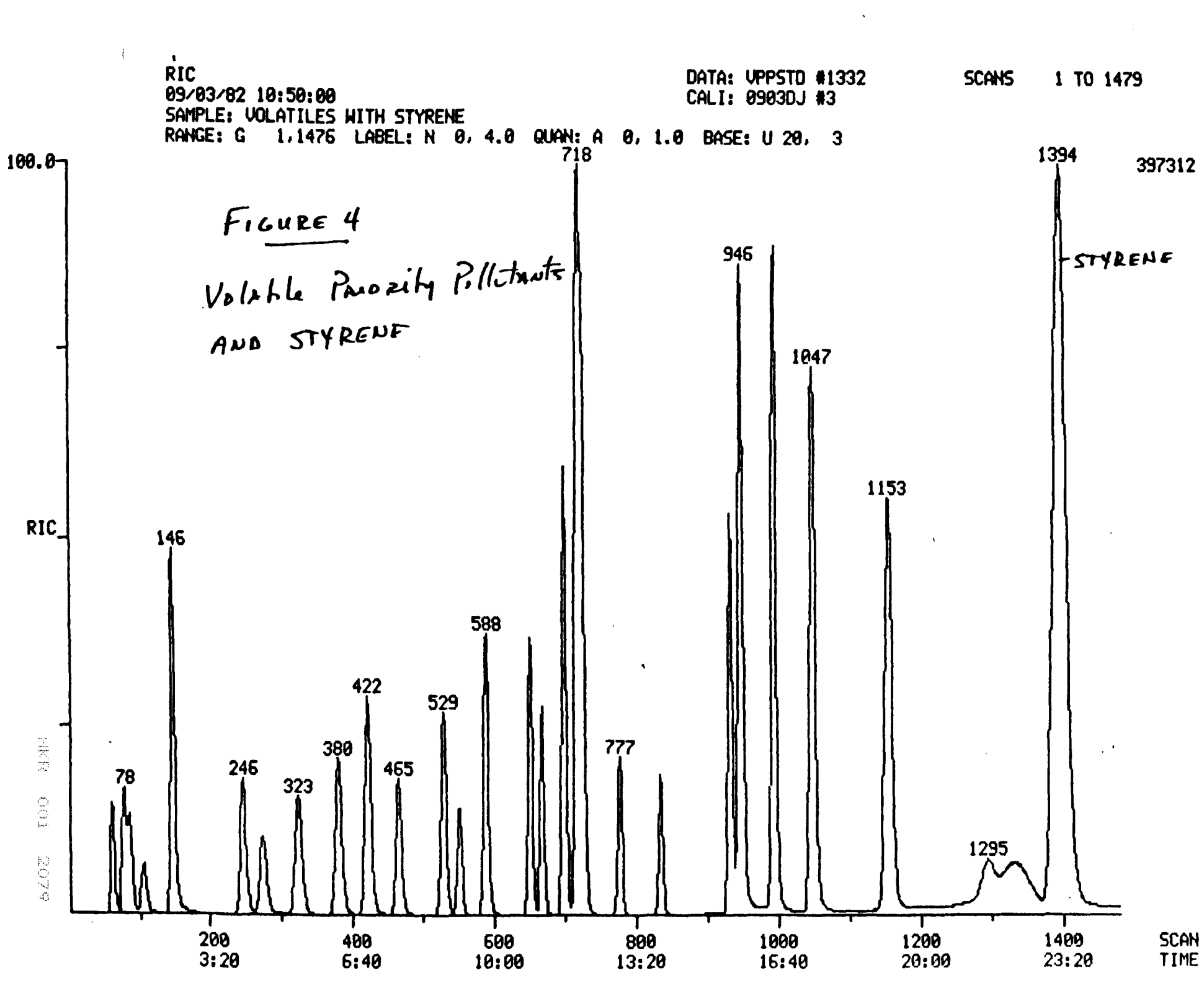
DATA: ETCTEST #2574
CALI: NS0831A #1

BASE M/E: 51
RIC: 516096.

Figure 3

MOCA




RIC
09/03/82 10:50:00
SAMPLE: VOLATILES WITH STYRENE
RANGE: G 1.1476 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: VPPSTD #1332
CALI: 0903DJ #3
SCANS 1 TO 1479
100.0
RIC
397312
FIGURE 4
Volatile Priority Pollutants
AND STYRENE
78
146
246
323
380
422
465
529
588
718
777
946
1047
1153
1295
1394
STYRENE
200
3:20
400
6:40
600
10:00
800
13:20
1000
16:40
1200
20:00
1400
23:20
SCAN
TIME

hooker

August 16, 1982

To: R. Hall

From: N. Simon, D. Johnson

Distribution: P. Skotnicki, A. Weston

Reference: GC/MS Analysis of Soil Samples for Volatile Priority Pollutants

I. Summary

This report summarizes the GC/MS sample preparation and analyses of six soil samples taken at the Arecibo facility on 8/ /82. The methodology used was as developed for the EPA. It is considered semi-quantitative because of variances in the sampling, sample handling and the sample matrix.

Sample 00003 (STP Plant across from PRC/sewer bottoms in sewer dumping spot #5) was the only sample where priority pollutant volatile organics were detected at greater than 10 ug/L. The compounds found were benzene, toluene and chlorobenzene. Vinyl chloride, 1,1-dichloroethylene, trans-1,2-dichloroethylene and trichloroethylene were not detected in any of the samples. Toluene was only detected in 00003. Non-volatile priority pollutants found were xylenes in sample 00003 and dichlorobenzene in 00092.

II. Experimental

The EPA priority pollutant method is described in Special Report No. 1 "Development of Analytical Test Procedures for the Measurement of Organic Priority Pollutants in Sludges and Sediment", published June 26, 1979 under contract No. 68-03-2695, MRI Project No. 4583-A. The only significant deviation from the published method was the use of a larger sample to give a lower detection limit.

A. Instrumental Parameters

Purge and Trap Conditions
(Tekmar Liquid Sample Concentrator-Model LSC-2)

Plumbing	-	Hard plumbed from trap effluent to the GC flow controller via a 1/8 inch O.D. copper line.
Trap Column	-	12" X 1/4" stainless steel tubing packed with Tenax 60/80 mesh. Baked after each run at 250^{o} for 20+ min.
Purge	-	12 minutes at 30 cc/minute
Desorb	-	4 minutes at 195^{o}C
Sample Size	-	0.5g in 5ml distilled water

Gas Chromatographic Conditions (Finnigan 9610)

Column	-	8 foot by 1/4 inch (2 mm I.D.) glass packed with 60/80 Carbopack C/0.2% CW 1500
Carrier	-	Helium at 25 cc/minute
Injector	-	180°C
GC/MS Interface	-	250°
Column Program	-	50° for purge, desorb and three minutes after desorb; 8°/min. to 180°; held for 30 min. at 180°

Mass Spectrometer Conditions

Instrument	-	Finnigan 4000 GC/MS interfaced with an Incos Data Acquisition System
Source Parameters	-	260°, Electron Impact Source with 70 eV ionizing electrons
Manifold Temperature	-	90°
Electron Multiplier	-	1330
Scan Parameters	-	Total scan sequence of 1 second consisting of data acquisition during 0.95 sec. up scan, 0.05 sec. hold at bottom. Mass range scanned 45-180

B. Sample Preparation

The sample for each site was received in a wide mouth glass quart bottle with a teflon cover. (There was considerable head space in each bottle). One half ml. (∿ 0.5g) was transferred, using a tipless disposable pipet, to a Tekmar tube. Five mls of distilled water and 5 ml of an internal standard solution were added. The tube was immediately attached to the Tekmar and purged.

Since the samples did not appear to be homogenous and since there was one to three inches of headspace, the 0.5ml aliquot was taken from the bottom half of the bottle and each sample was analyzed in duplicate.

The samples were refrigerated until one hour before analysis.

C. Standards

The standards used were supplied by Supelco and are described as "Standards for EPA Consent Decree Protocol". They are further referenced to (I.F.B. No. WA77-B133, Appendix B, Sampling and Analysis for Priority Pollutants, US EPA).

Bromochloromethane, 2-Bromo-1-chloropropene and 1,4-dichlorobutane were used as internal standards.

The stock solutions, as received from Supelco, were stored in a freezer. Dilutions were stored in the refrigerator in 15 ml hypovials until one hour before analysis. Standards were prepared to give concentration levels of 10 µg/L (5 ng injected) and 100 ug/L (50 ng injected). An additional standard at 50 ug/L (25 ng injected was analyzed to verify linearity. Internal standards were prepared at 20 ug/L; 5 ul (100 ng injected) was used to spike each standard and sample.

III. Quality Assurance

All six samples were analyzed in duplicate. A blank was prepared using 1/2 ml of soil and 5 mls of distilled water. The blank was analyzed each day to verify the absence of sample handling contamination. Three spiked samples were prepared at 10 or 20 ug/L, two from the lab blank and one an actual sample.

Linearity was verified with a three point curve (10, 50 and 100 ug/L) and a three component internal standard was added to each sample and standard.

The significant amount of headspace and the non uniformity of each sample limits the quantitative conclusions that normally could be assumed with the rigorous quality assurance protocal. Sample 00003 was the most obvious example; a mixture of soil and black sludge that was impossible to accurately reproduce in the transfer.

V. Results and Conclusions

The results are listed in Table 1. % recoveries from the three spikes are listed in Table 2. Chromatograms of each sample follow the tables.

Nan Simon

nw/

ments

TABLE 1

RESULTS SUMMARY

C.S. Log #	20811	20812	20813*	20814**	20815	20816
Sample I.D.	00061	00002	00003	00092	00090	00062
Chloromethane	ND	ND	ND	ND	ND	ND
Bromomethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Vinylchloride	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Chloroethane	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}
Methylene Chloride	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND
1.1-Dichloroethylene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
1,1-Dichloroethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Trans-1,2-Dichloroethylene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Chloroform	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
1,2-Dichloroethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
1,1,1-Trichloroethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Carbon Tetrachloride	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}
Bromodichloromethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
1,2-Dichloropropane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Trans-1,3-Dichloropropene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Trichloroethylene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Dibromochloromethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Cis-1,3-Dichloropropene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Benzene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Bromoform	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}	ND_{50}
1,1,2,2-Tetrachloroethene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
1,1,2,2-Tetrachloroethane	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}
Toluene	ND_{10}	ND_{10}	19 11	ND_{10}	ND_{10}	ND_{10}
Chlorobenzene	ND_{10}	ND_{10}	134 66	ND_{10}	ND_{10}	ND_{10}
Ethylbenzene	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}	ND_{10}

* Xylenes also detected

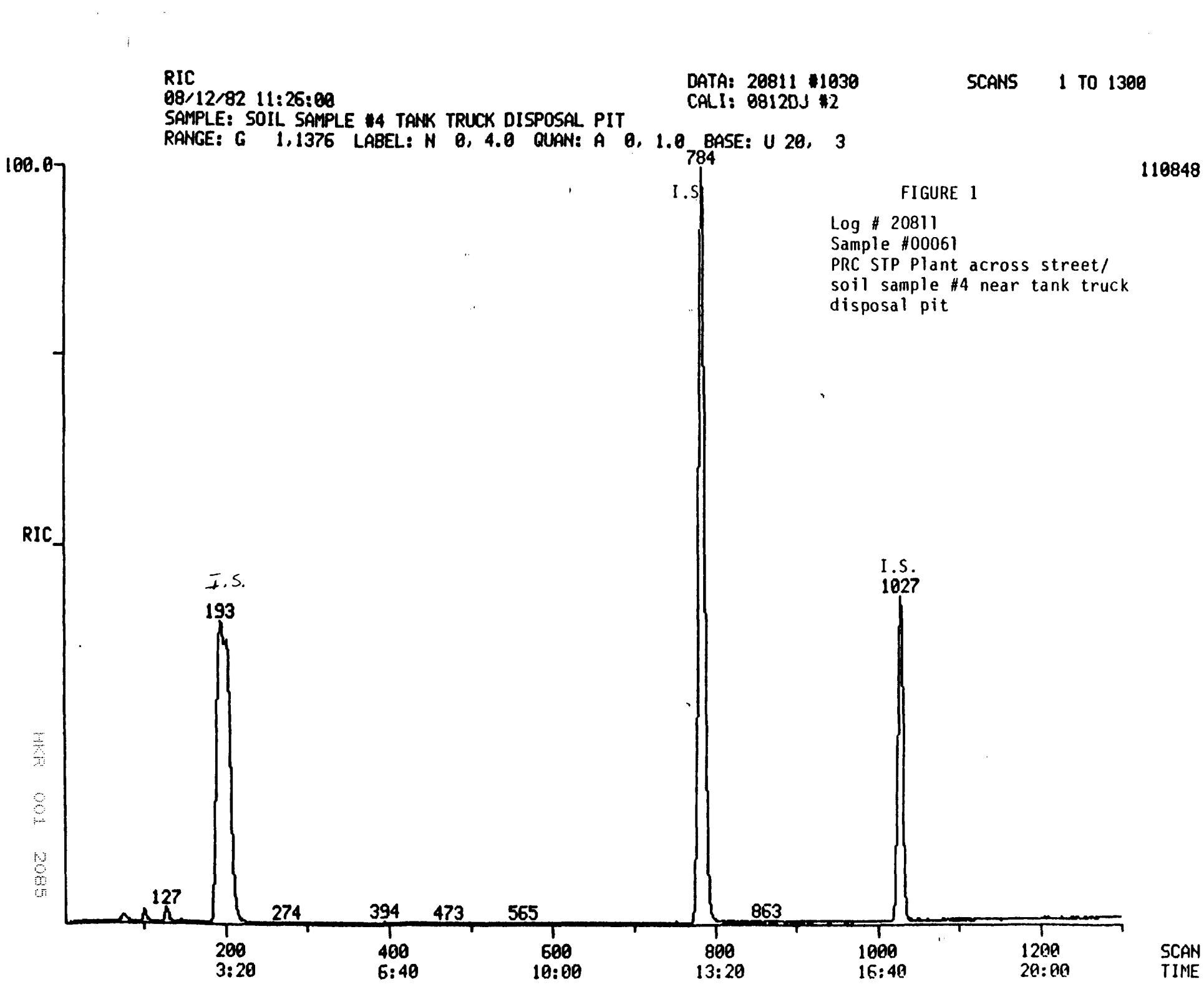
** A significant amount of dichlorobenzene was detected

TABLE II

% RECOVERY FROM SPIKED SOIL

	D.L. ug/L	Blank Soil @ 10 ug/L	Blank Soil @ 20 ug/L	20811-00061 Soil @ 20 ug/L
Chloromethane	No std.	ND	ND	ND
Bromomethane	10	136%	103%	110%
Vinylchloride	10	103	105	117
Chloroethane	50	ND	ND	123
Methylene Chloride	10	143	161	550*
Trichlorofluoromethane	No std.	ND	ND	ND
1.1-Dichloroethylene	10	108	105	103
1,1-Dichloroethane	10	102	92	114
Trans-1,2-Dichloroethylene	10	100	94	111
Chloroform	10	106	97	100
1,2-Dichloroethane	10	140	100	110
1,1,1-Trichloroethane	10	109	102	121
Carbon Tetrachloride	50	ND	ND	ND
Bromodichloromethane	10	105	101	115
1,2-Dichloropropane	10	147	103	84
Trans-1,3-Dichloropropene	10	90	78	148
Trichloroethylene	10	84	76	95
Dibromochloromethane	10	82	98	101
Cis-1,3-Dichloropropene	10	143	100	110
Benzene	10	96	88	105
Bromoform	50	ND	ND	ND
1,1,2,2-Tetrachloroethene	10	158	155	144
1,1,2,2-Tetrachloroethane	10	83	74	67
Toluene	10	125	138	580*
Chlorobenzene	10	94	85	105
Ethylbenzene	10	108	98	124

* It can reasonably be assumed that the large recovery is contribution from the sample #20811 - identified as 00061. However, neither compound was found in the unspiked sample.


RIC
08/12/82 11:26:00
SAMPLE: SOIL SAMPLE #4 TANK TRUCK DISPOSAL PIT
RANGE: G 1,1376 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
DATA: 20811 #1030
CALI: 0812DJ #2
SCANS 1 TO 1300
100.0
RIC
784
I.S
110848
FIGURE 1
Log # 20811
Sample #00061
PRC STP Plant across street/
soil sample #4 near tank truck
disposal pit
I.S.
193
I.S.
1027
127
274
394
473
565
863
200
3:20
400
6:40
600
10:00
800
13:20
1000
16:40
1200
20:00
SCAN
TIME
HRR 001 2085

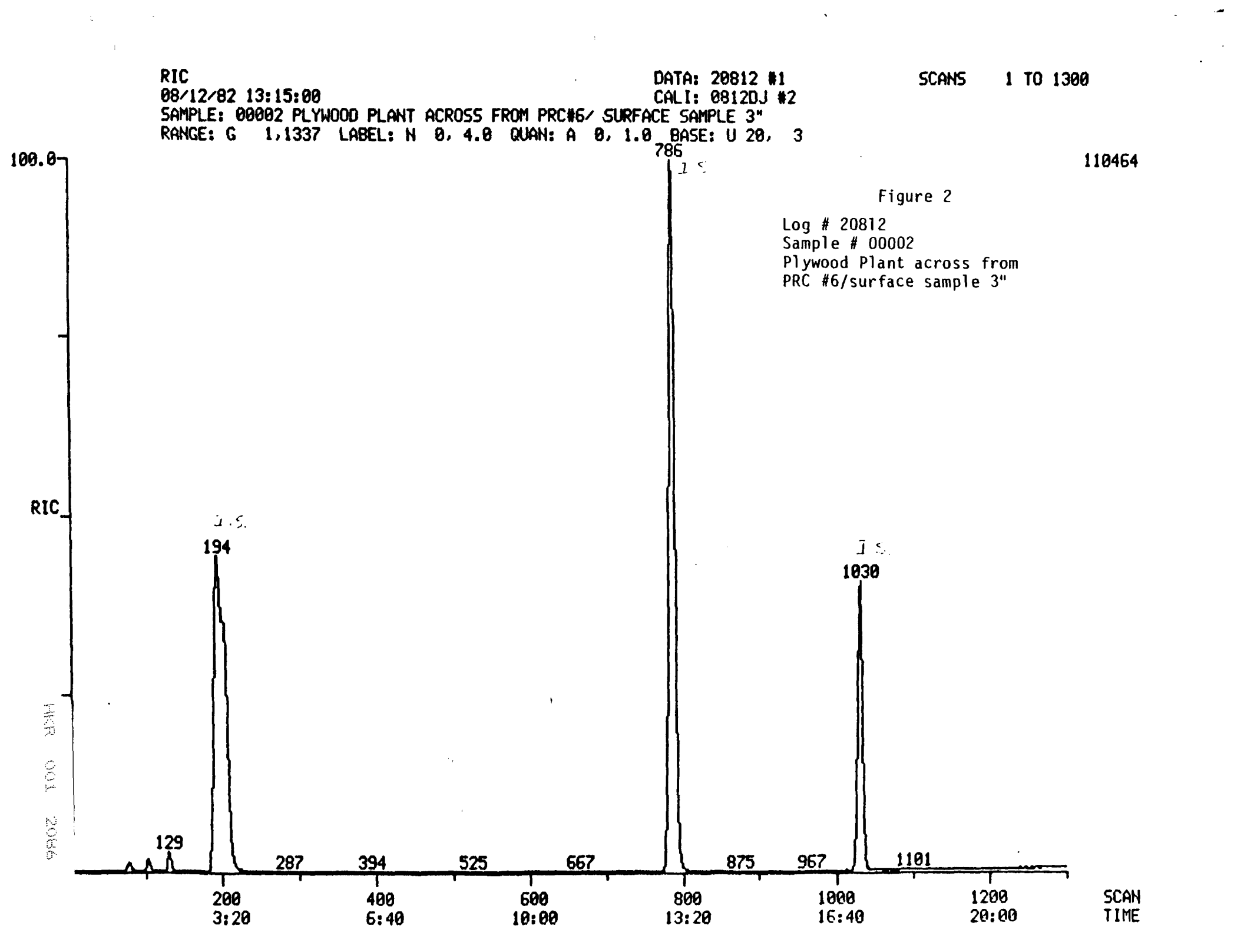
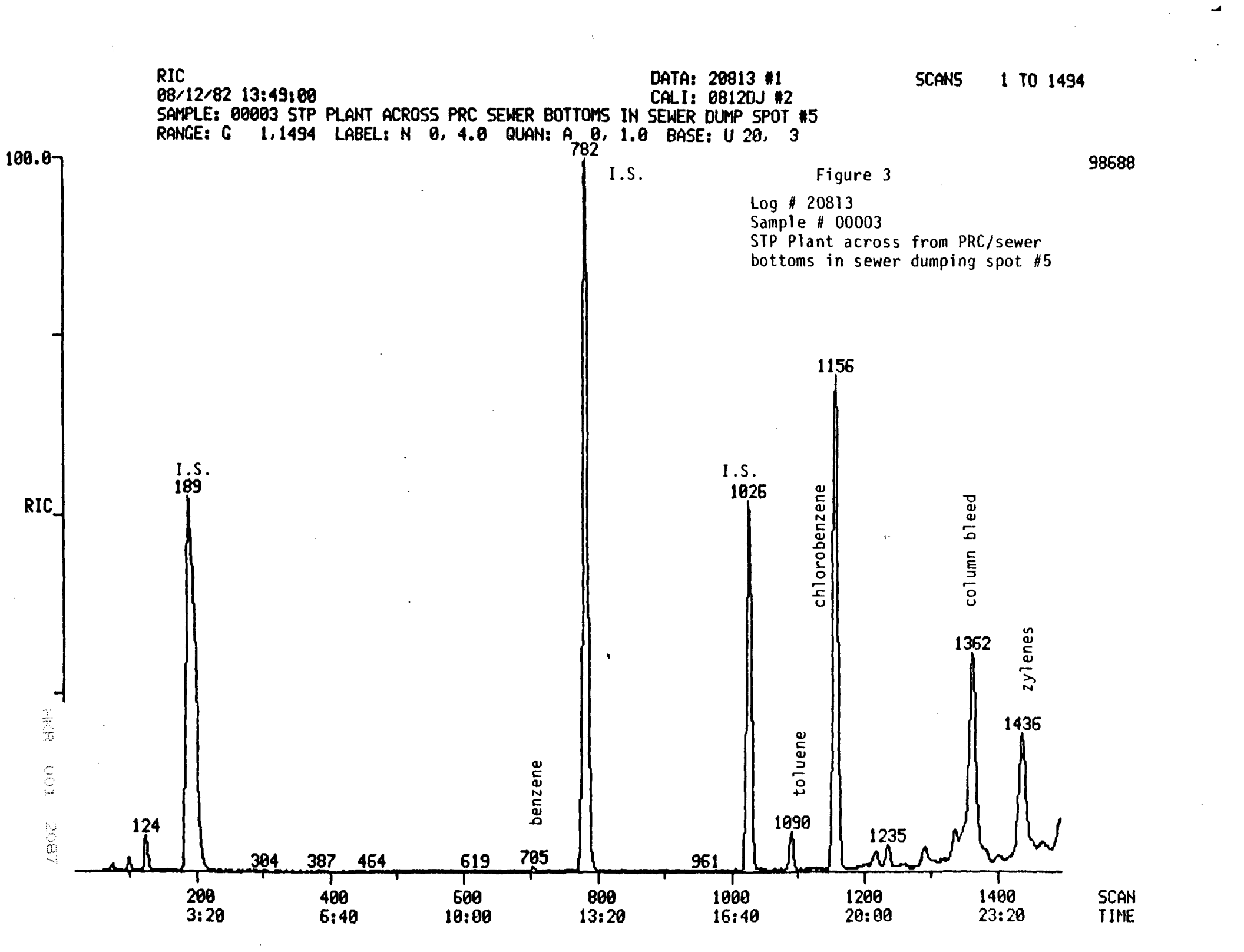


Figure 2

Log # 20812
Sample # 00002
Plywood Plant across from
PRC #6/surface sample 3"


RIC
08/12/82 13:49:00
DATA: 20813 #1
CALI: 0812DJ #2
SCANS 1 TO 1494
SAMPLE: 00003 STP PLANT ACROSS PRC SEWER BOTTOMS IN SEWER DUMP SPOT #5
RANGE: G 1,1494 LABEL: N 0, 4.0 QUAN: A 0, 1.0 BASE: U 20, 3
100.0
98688
RIC
Figure 3
Log # 20813
Sample # 00003
STP Plant across from PRC/sewer
bottoms in sewer dumping spot #5
782
I.S.
I.S.
189
I.S.
1026
1156
chlorobenzene
column bleed
1362
zylenes
1436
toluene
1090
benzene
705
124
304
387
464
619
961
1235
200
3:20
400
6:40
600
10:00
800
13:20
1000
16:40
1200
20:00
1400
23:20
SCAN
TIME

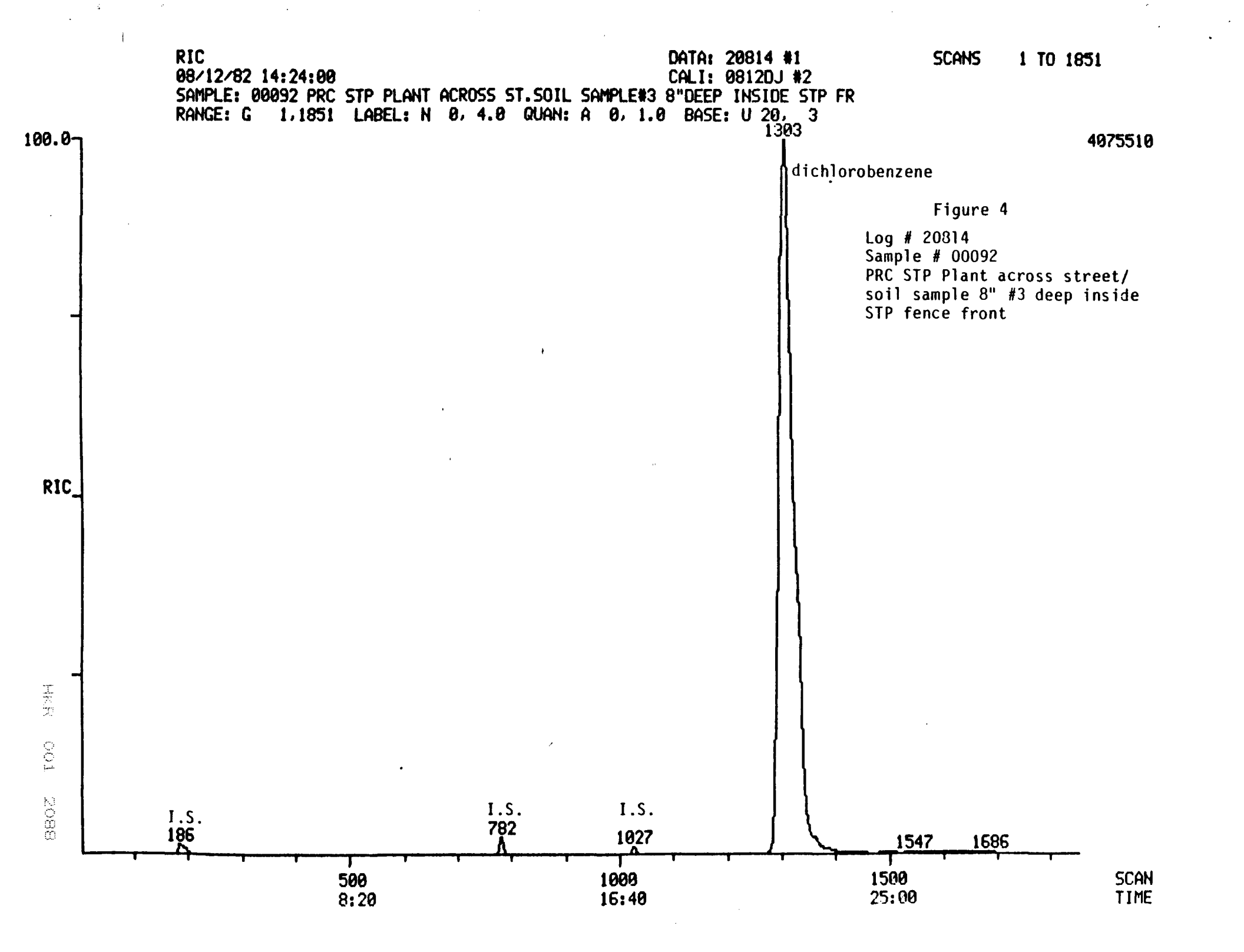


Figure 4

Log # 20814
Sample # 00092
PRC STP Plant across street/
soil sample 8" #3 deep inside
STP fence front

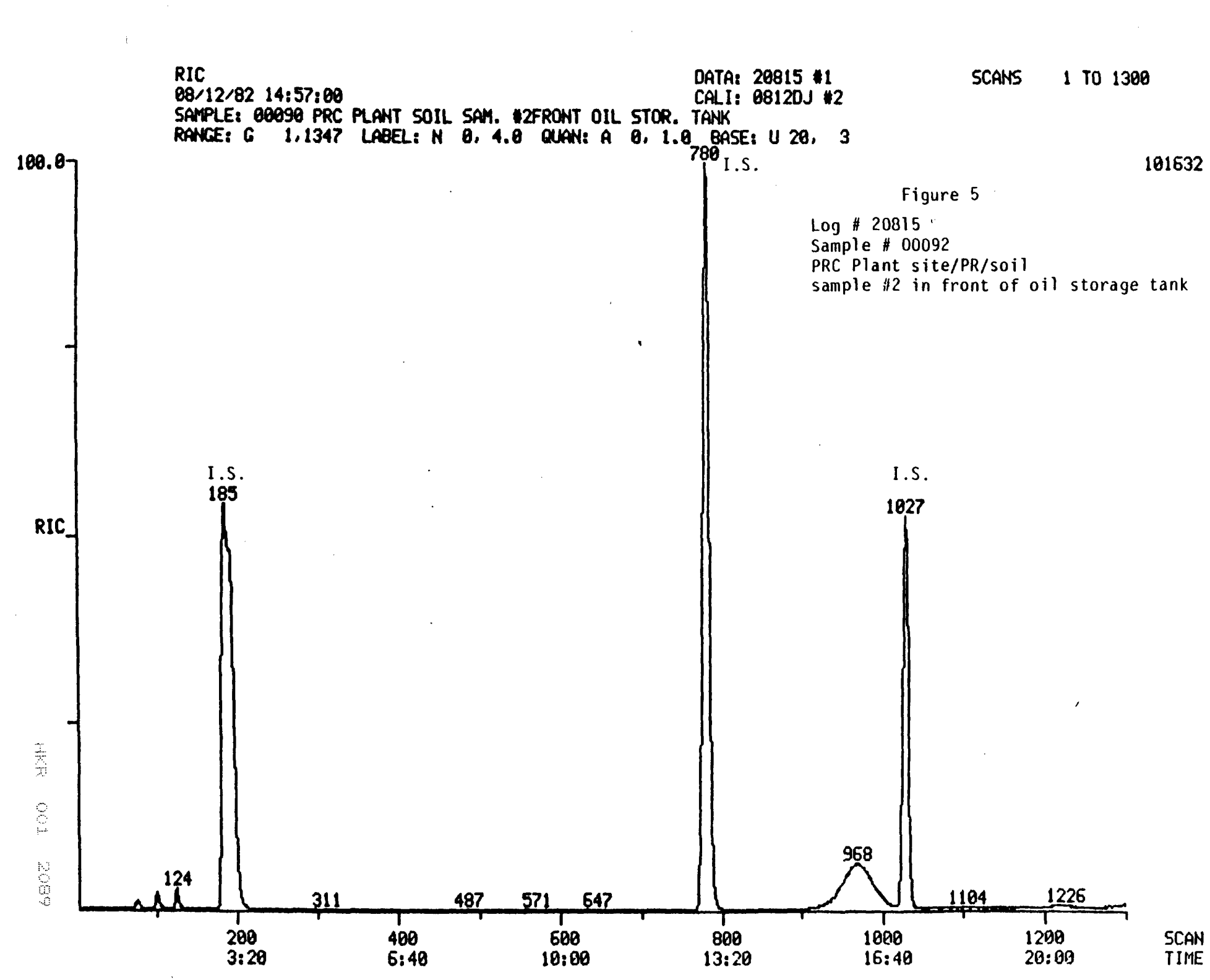


Figure 5

Log # 20815
Sample # 00092
PRC Plant site/PR/soil
sample #2 in front of oil storage tank

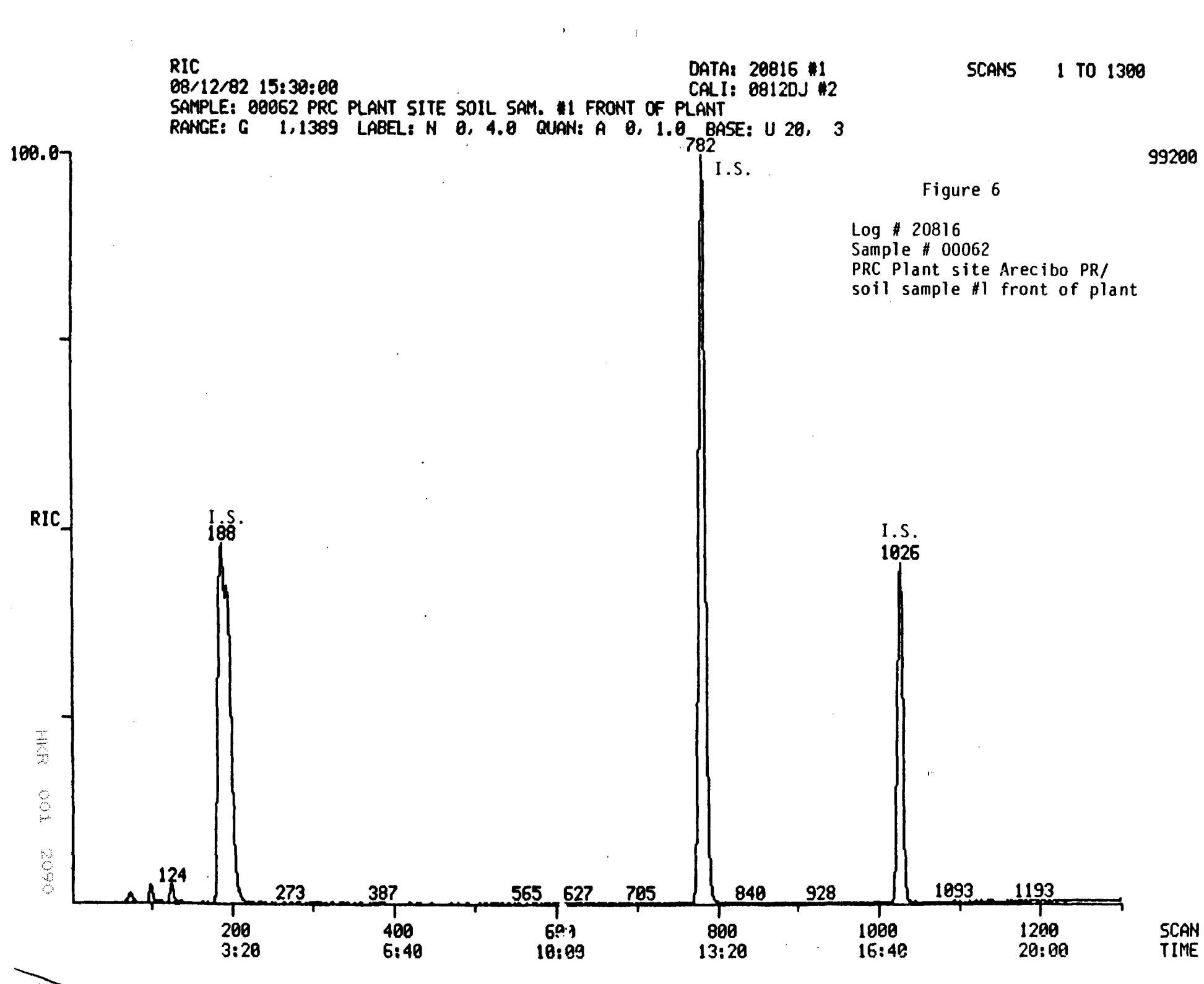


Figure 6

Log # 20816
Sample # 00062
PRC Plant site Arecibo PR/
soil sample #1 front of plant

APPENDIX O

Air Monitoring Proceedures, Çalibration and Specifications

SAMPLING TOTAL PARTICULATES USING GRAVIMETRIC FILTER ANALYSIS

1.0 General Applicability

1.1 Ambient air concentrations of total particulates will be determined by drawing ambient air through a pre-weighed PVC filter, and then re-weighing the filter to determine the total weight gained. The sample collection procedure involves determining the volume of air sampled through measurement of flow rate and sample duration.

1.2 The collection filter consists of a 37 mm diameter polyvinyl chloride (PVC) filter with a pore size of 5 µm, a cellulose support pad, and a polystyrene filter holder. These filters will meet the requirements set forth in NIOSH Method 0500.

1.3 The sampling and analysis procedure used in this program will follow NIOSH Method 0500.

AIR SAMPLING WORKSHEET

OCCIDENTAL CHEMICAL CORPORATION
INDUSTRIAL HYGIENE

FACILITY _____ SAMPLING DATE _____

PERSON PERFORMING SAMPLING _____

Employee (Name, Social Security Number)

Job Title | Pump Checks and Adjustments

PPE (Type)

Job Description, Operation, Work Location(s), Ventilation and Controls

Temperature: Relative Humidity: Wind Speed, Direction:

PUMP NUMBER:	SAMPLING DATA					
Lab Sample Number						
Sample Submission Number						
Sample Type						
Sample Media						
Filter/Tube Number						
Time ON/OFF						
Total Time (In Minutes)						
Flow Rate ☐ l/min ☐ cc/min.						
Volume (In Liters)						
Net Sample Weight (In mg)						
Analyze Samples For:	Indicate Which Samples to Include in TWA, Ceiling, STEL, etc. Calculations					

Interferences and Comments to Lab

Supporting Samples
a. Blanks: _____
b. Bulks: _____

Chain of Custody	Initials Y	N	DATE
a. Seals Intact ?			
b. Rec'd in Lab			
c. Rec'd by Anal			
d. Anal Compl'd			
e. Calc Checked			
f. Supr Ok'd			

PRE-SAMPLING CALIBRATION RECORDS

PRE	Pump Mfg & SN	Flow Rate Calculations			
	Voltage Checked Yes No				
	Location / T & Alt.				
		Flow Rate	Method ☐ Bubble ☐ PR	Initials	Date / Time

POST-SAMPLING CALIBRATION RECORDS

POST	Location / T & Alt.	Flow Rate Calculations		
	Flow Rate	Initials	Date / Time	

SAMPLE WEIGHT CALCULATIONS

Filter No.					
Final Weight (mg)					
Initial Weight (mg)					
Weight Gained (mg)					
Blank Adjustment					
Net Sample Weight (mg)					

CALCULATIONS AND NOTES:

SAMPLING AND ANALYSIS: Volatile Organics Using NOISH Method 1003

1.0 General Applicability

1.1 Ambient air concentrations of volatile organic constituents will be determined by drawing ambient air through cartridges of activated charcoal, and then desorption and analysis of the collected contaminants in the laboratory. The sample collection procedure involves operating the pumps at 50 cc/min over an eight-hour work day and between 10 to 15 liters of air will be collected. These operating parameters are based on the low breakthrough volume of vinyl chloride.

1.2 Charcoal cartridges will consist of a column of activated charcoal bound on either end by glass wool plugs and sealed in a glass tube. These charcoal tubes will be SKC, 400 mg x 200 mg or performance equivalent.

2.0 Procedure

2.1 The sampling and analysis procedure used in program will follow NIOSH Method 1003 (NIOSH Manual of Analytical Methods, 3rd Edition).

2.2 The GC equipment and column conditions for the Confirmatory Analysis will be the following:

Gas Chromatograph

-- Hewlet-Packard 5840A equipped with flame ionization detector and automatic liquid sampler or performance equivalent.

SAMPLING AND ANALYSIS: Volatile Organics Using NOISH Method 1003

Column

-- Supelco 20 foot by 1/8 inch stainless packed with 10% SP-1000 on Carbopak B or performance equivalent.

Injection Temperature

-- To be determined

Detection Temperature

-- 275°

Column Oven Temperature

-- 80° for 12 minutes, then 5°/minute to 150° with hold for 15 minutes.

Carrier Gas

-- N_2 at 23.5 cc/minute.

DEFINITION: Total aerosol mass

NUISANCE DUST, TOTAL

METHOD: 0500
ISSUED: 2/15/84

OSHA: 15 mg/m³
NIOSH: no standard
ACGIH: 10 mg/m³, total dust less than 1% quartz

PROPERTIES: quartz less than 1% [1]

SYNONYMS: boron oxide (CAS #1303-86-2) and nuisance dusts [1] including alumina (CAS #1344-28-1), calcium carbonate (CAS #1317-65-3), cellulose (paper fiber; CAS #9004-34-6), glycerin mist (CAS #56-81-5), limestone (CAS #1317-65-3), etc.

SAMPLING

SAMPLER: FILTER
(tared 37-mm, 5-µm PVC filter)

FLOW RATE: 1.5 to 2 L/min

VOL-MIN: 25 L @ 15 mg/m³
-MAX: 133 L @ 15 mg/m³

SHIPMENT: routine

SAMPLE STABILITY: indefinitely

BLANKS: 2 field blanks per 10 samples

BULK SAMPLE: none required

ACCURACY

RANGE STUDIED: 8 to 28 mg/m³

BIAS: not significant

OVERALL PRECISION (s_r): 0.056 [2]

MEASUREMENT

TECHNIQUE: GRAVIMETRIC (FILTER WEIGHT)

ANALYTE: airborne particulate material

BALANCE: 0.01 mg sensitivity or better; use same balance before and after sample collection

CALIBRATION: National Bureau of Standards Class M weights

RANGE: 0.3 to 2 mg per sample

ESTIMATED LOD: 0.2 mg per sample

PRECISION: 0.08 mg per sample [3]

APPLICABILITY: The working range is 3 to 20 mg/m³ for a 100-L air sample. This method is nonspecific and determines the total dust concentration to which a worker is exposed. It may be applied, e.g., to gravimetric determination of fibrous glass [4] in addition to the other ACGIH nuisance dusts [1].

INTERFERENCES: Organic and volatile particulate matter may be removed by dry ashing [4].

OTHER METHODS: This method is similar to the criteria document method for fibrous glass [4] and Method 5000 for carbon black. This method replaces Method S349 [5]. Impingers and direct-reading instruments may be used to collect total dust samples, but these have limitations for personal sampling.

EQUIPMENT:

1. Environmental chamber at constant temperature and humidity (e.g., 20 °C ± 0.3 °C and 50% ± 5% RH).
2. Sampler: 37-mm PVC, 2- to 5-μm pore size membrane or equivalent hydrophobic filter and cellulose supporting pad in 37-mm cassette filter holder.
3. Personal sampling pump, 1.5 to 2 L/min, with flexible connecting tubing.
4. Microbalance, capable of weighing to 0.01 mg.
5. Vacuum desiccator.
6. Static neutralizer: e.g., Po-210; replace nine months after the production date.

SPECIAL PRECAUTIONS: None.

PREPARATION OF FILTERS BEFORE SAMPLING:

1. Dry filters and backup pads under vacuum in the vacuum desiccator for at least 15 min.
2. Release the vacuum, remove the desiccator cover and equilibrate the filters in the environmental chamber for at least 1 hr.
3. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
4. Weigh the filters in the environmental chamber. Record the filter tare weight, W_1 (mg).
   a. Zero the balance before each weighing.
   b. Handle the filter with forceps (nylon forceps if further analyses will be done).
   c. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
5. Place the weighed filters on top of the backup pads in the filter cassette bottom sections and allow to stand an additional 8 to 16 hrs in the environmental chamber.
6. Reweigh the filters. If this tare weight differs by more than 0.01 mg from the first tare weight obtained in step 4 above, discard the filter.
   NOTE: Insert a rod through the outlet hole of the filter cassette bottom section to raise the backup pad and filter so that the filter can be grasped with forceps.
7. Assemble the filter in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry and mark with the same number as the backup pad.

SAMPLING:

8. Calibrate each personal sampling pump with a representative sampler in line.
9. Sample at 1.5 to 2 L/min. Do not exceed a total filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

10. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
11. Remove the top and bottom plugs from the filter cassette. Place the filter cassettes in a vacuum desiccator under vacuum for at least 15 min, followed by equilibration for at least 1 hr in the environmental chamber.
12. Remove the cassette band, pry open the cassette and remove the filter. Handle the filters very gently by the edge to avoid loss of dust.

NOTE: If the filter sticks to the underside of the cassette top, very gently lift away by using the dull side of a scalpel blade. This must be done carefully or the filter will tear.

CALIBRATION AND QUALITY CONTROL:

13. Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Maintain and calibrate the balance with National Bureau of Standards Class M weights.
14. Take two to four replicate samples for every batch of field samples for quality assurance on the sampling procedures. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [6] or in the field.. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. The relative standard deviation calculated from these replicates should be recorded on control charts and action taken when the precision is out of control.

MEASUREMENT:

15. Weigh each filter, including field blanks. Record this post-sampling weight, W_2 (mg), beside its corresponding tare weight. Record anything remarkable about a filter (e.g., overload, leakage, wet, torn, etc.).

CALCULATIONS:

16. Calculate the concentration of total nuisance dust, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) \pm B}{V} \cdot 10^3, \ mg/m^3$$

where: W_1 = tare weight of filter before sampling (mg)
W_2 = post-sampling weight of sample-containing filter (mg)
B = mean change in field blank filter weights between tare and post-sampling (mg) (+ or -).

EVALUATION OF METHOD:

Lab testing with blank filters and generated atmospheres of carbon black was done at 8 to 28 mg/m^3 [2,6]. Precision and accuracy data are given on page 0500-1.

REFERENCES:

[1] TLVs - Threshold Limit Values for 1983-84, Appendix D, ACGIH, Cincinnati, OH (1983).
[2] This Manual, Method 5000.
[3] Unpublished data from Non-textile Cotton Study, NIOSH/DRDS/EIB.
[4] NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Fibrous Glass, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-152, 119-142 (1977).
[5] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
[6] Documentation of the NIOSH Validation Tests, S262 and S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).

METHOD WRITTEN BY: Kathy Morring, Jerry Clere, and Frank Hearl, P.E., NIOSH/DRDS.

FORMULA: Table 1

M.W.: Table 1

HYDROCARBONS, HALOGENATED

METHOD: 1003
ISSUED: 2/15/84
REVISION #1: 8/15/87

COMPOUNDS: (synonyms in Table 1)	benzyl chloride	chlorobromomethane	1,1-dichloroethane	methylchloroform
	bromoform	chloroform	1,2-dichloroethylene	tetrachloroethylene
	carbon tetrachloride	o-dichlorobenzene	ethylene dichloride	1,1,2-trichloroethane
	chlorobenzene	p-dichlorobenzene	hexachloroethane	1,2,3-trichloropropane

SAMPLING

SAMPLER: SOLID SORBENT TUBE
(coconut shell charcoal, 100 mg/50 mg)

FLOW RATE: 0.01 to 0.2 L/min

VOL-MIN: Table 2
-MAX: Table 2

SHIPMENT: routine

SAMPLE STABILITY: not determined

FIELD BLANKS: 10% of samples

ACCURACY

RANGE STUDIED: see EVALUATION OF METHOD [1]

BIAS: not significant [1]

OVERALL PRECISION (s_r): see EVALUATION OF METHOD [1]

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, FID

ANALYTE: compounds above

DESORPTION: 1 mL CS_2, stand 30 min

INJECTION VOLUME: 5 µL

TEMPERATURES: Table 3

CARRIER GAS: N_2 or He, 30 mL/min

COLUMN: Table 3; alternates are SP-2100, SP-2100 with 0.1% Carbowax 1500 or DB-1 fused silica capillary column

CALIBRATION: standard solutions of analyte in CS_2

RANGE: Table 3

ESTIMATED LOD: 0.01 mg per sample [2]

PRECISION (s_r): see EVALUATION OF METHOD [1]

APPLICABILITY: See Table 2 for working ranges. This method can be used for simultaneous determination of two or more substances suspected to be present by changing gas chromatographic conditions (i.e., temperature program). High humidity during sampling will prevent organic vapors from being trapped efficiently on the sorbent and greatly decreases breakthrough volume.

INTERFERENCES: None identified. The chromatographic column or separation conditions may be changed to circumvent interferences.

OTHER METHODS: This method combines and replaces P&CAM 127 [3], S101 [4], S110 [5], S113 [6], S114 [7], S115 [8], S122 [9], S123 [10], S126 [11], S133 [12], S134 [13], S135 [14], S281 [15], S314 [16], S328 [17], S335 [18], S351 [19], and Method 1003 (dated 2/15/84).

REAGENTS:

1. Carbon disulfide, chromatographic quality.*
2. Analyte, reagent grade.
3. Calibration stock solutions:
   a. benzyl chloride, 10 mg/mL in n-heptane.
   b. bromoform, 10 mg/mL in n-hexane.
   c. o-dichlorobenzene, 200 mg/mL in acetone.
   d. p-dichlorobenzene, 300 mg/mL in acetone.
   e. hexachloroethane, 25 mg/mL in toluene.
4. Decane, n-undecane, octane or other internal standards (see step 6).
5. Nitrogen or helium, purified.
6. Hydrogen, prepurified.
7. Air, filtered.

*See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: glass tube, 7 cm long, 6 mm OD, 4 mm ID, flame-sealed ends with plastic caps, containing two sections of 20/40 mesh activated (600 °C) coconut shell charcoal (front = 100 mg; back = 50 mg) separated by a 2-mm urethane foam plug. A silylated glass wool plug precedes the front section and a 3-mm urethane foam plug follows the back section. Pressure drop across the tube at 1 L/min airflow must be less than 3.4 kPa. Tubes are commercially available (e.g., SKC #226-01).
2. Personal sampling pump, 0.01 to 0.2 L/min, with flexible connecting tubing.
3. Gas chromatograph, FID, integrator and column (see Table 3).
4. Vials, 2-mL, glass, PTFE-lined septum crimp caps.
5. Volumetric flasks, 10-mL.
6. Syringes, 10-µL, readable to 0.1 µL.
7. Pipet, TD, 1-mL, with pipet bulb.

SPECIAL PRECAUTIONS: Carbon disulfide is toxic and a serious fire and explosion hazard (flash point = -30 °C); work with it only in a hood. Several of the analytes are suspect carcinogens (Table 1). n-Heptane, n-hexane, and acetone are fire hazards.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.01 and 0.2 L/min for a total sample size between the limits shown in Table 2.
4. Cap the samplers. Pack securely for shipment.

SAMPLE PREPARATION:

5. Place the front and back sorbent sections of the sampler tube in separate vials. Discard the glass wool and foam plugs.
6. Add 1.0 mL CS_2 to each vial. Cap each vial.
   NOTE: A suitable internal standard, such as decane [16], n-undecane [6,19], or octane [9,13,17] at 0.1% (v/v) may be added at this step and at step 8.
7. Allow to stand 30 min with occasional agitation.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least five working standards over the appropriate range (Table 3).
   a. Add known amounts of neat analyte or calibration stock solution to CS_2 in 10-mL volumetric flasks and dilute to the mark.
   b. Analyze with samples and blanks (steps 11 and 12).
   c. Prepare calibration graph (peak area vs. mg analyte).
9. Determine desorption efficiency (DE) at least once for each lot of charcoal used for sampling in the range of interest. Prepare three tubes at each of five levels plus three media blanks.

a. Remove and discard back sorbent section of a media blank sampler.
b. Inject a known amount (2 to 20 µL) of pure analyte, or calibration stock solution (see REAGENTS, 3.), directly onto front sorbent section with a microliter syringe.
c. Cap the tube. Allow to stand overnight.
d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
e. Prepare a graph of DE vs. mg analyte recovered.

10. Analyze three quality control blind spikes and three analyst spikes to insure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 1003-1 and in Table 3. Inject sample aliquot manually using solvent flush technique or with autosampler.
NOTE: If peak area is above the linear range of the working standards, dilute with CS_2, reanalyze and apply the appropriate dilution factor in calculations.
12. Measure peak area.

CALCULATIONS:

13. Determine the mass, mg (corrected for DE), of analyte found in the sample front (W_f) and back (W_b) sorbent sections and in the average media blank front (B_f) and back (B_b) sorbent sections.
NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of analyte in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Laboratory testing was performed with spiked samples and generated atmospheres using SKC Lot 105 coconut shell charcoal [1]. Results were:

Compound	Range, mg/m³	Sample Size	Precision (s_r) Overall	Precision (s_r) Measurement	Desorption Efficiency	Ref.
Benzyl chloride	2-8	10 L	0.096	0.031	0.90 @ 0.03-0.1 mg	[8]
Bromoform	3-10	10 L	0.071	0.043	0.80 @ 0.025 mg	[7]
Carbon tetrachloride	65-299	15 L	0.092	0.037	0.96 @ 1.3-4.8 mg	[16]
Chlorobenzene	183-736	10 L	0.056	0.025	0.91 @ 1.8-7.1 mg	[12]
Chlorobromomethane	640-2655	5 L	0.061	0.051	0.94 @ 3.3-13 mg	[6]
Chloroform	100-416	15 L	0.057	0.047	0.97 @ 1.8-7.4 mg	[19]
o-Dichlorobenzene	150-629	3 L	0.068	0.013	0.86 @ 0.5-1.9 mg	[14]
p-Dichlorobenzene	183-777	3 L	0.052	0.022	0.91 @ 0.7-2.7 mg	[15]
1,1-Dichloroethane	212-838	10 L	0.057	0.011	1.01 @ 1.9-8 mg	[10]
1,2-Dichloroethylene*	475-1915	3 L	0.052	0.017	1.00 @ 2.4-9.5 mg	[5]
Ethylene dichloride	195-819	3 L	0.079	0.012	0.96 @ 0.6-2.5 mg	[9]
Hexachloroethane	5-25	10 L	0.121	0.014	0.98 @ 0.05-0.2 mg	[4]
Methyl chloroform	904-3790	3 L	0.054	0.018	0.99 @ 2.9-11 mg	[17]
Tetrachloroethylene	655-2749	3 L	0.052	0.013	0.96 @ 2.1-8 mg	[18]
1,1,2-Trichloroethane	26-111	10 L	0.057	0.010	0.97 @ 0.3-1.2 mg	[13]
1,2,3-Trichloropropane	163-629	10 L	0.068	0.027	0.95 @ 1.5-6 mg	[11]

*isomer used (i.e., cis- or trans-) in evaluation unknown.

REFERENCES:
[1] Documentation of the NIOSH Validation Tests, S101, S110, S113, S114, S115, S122, S123, S126, S133, S134, S135, S281, S314, S328, S335, S351, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977), available as Stock No. PB 274-248 from NTIS, Springfield, VA 22161.
[2] User check, UBTL, NIOSH Sequences #3990-T, 3990-U and 3990-W (NIOSH, unpublished, November 3, 1983) and 4304-J (NIOSH, unpublished, April 3, 1984).
[3] NIOSH Manual of Analytical Methods, 2nd ed., V. 1., P&CAM 127, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
[4] Ibid., V. 2., S101. U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-B (1977).
[5] Ibid., S110.
[6] Ibid., S113.
[7] Ibid., S114.
[8] Ibid., S115.
[9] Ibid., S122.
[10] Ibid., S123.
[11] Ibid., S126.
[12] Ibid., S133.
[13] Ibid., S134.
[14] Ibid., V. 3, S135, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
[15] Ibid., S281.
[16] Ibid., S314.
[17] Ibid., S328.
[18] Ibid., S335.
[19] Ibid., S351.
[20] NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, U.S. Department of Health and Human Services, Publ. (NIOSH) 81-123 (1981), available as Stock #PB83-154609 from NTIS, Springfield, VA 22161.
[21] NIOSH Current Intelligence Bulletin 27, Chloroethanes: Review of Toxicity, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-181 (1978).
[22] NIOSH Current Intelligence Bulletin 20, Tetrachloroethylene (Perchloroethylene), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-112 (1978).
[23] Criteria for a Recommended Standard...Occupational Exposure to Benzyl Chloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-182 (1978).
[24] Criteria for a Recommended Standard...Occupational Exposure to Carbon Tetrachloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-133 (1976).
[25] Criteria for a Recommended Standard...Occupational Exposure to Chloroform, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 75-114 (1975).
[26] Criteria for a Recommended Standard...Occupational Exposure to Ethylene Dichloride, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-139 (1976).
[27] Criteria for a Recommended Standard...Occupational Exposure to 1,1,1-Trichloroethane, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-184 (1976).
[28] Criteria for a Recommended Standard...Occupational Exposure to Tetrachloroethylene (Perchloroethylene), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-185 (1976).

METHOD REVISED BY: G. D. Foley; Y. T. Gagnon; and K. J. Williams, NIOSH/DPSE; methods originally validated under NIOSH Contract CDC-99-74-45.

Table 1. General information.

Compound	M.W.	mg/m³ = 1 ppm @ NTP	Synonyms	OSHA/NIOSH/ACGIH (ppm)
Benzyl chloride* ($C_6H_5CH_2Cl$)	126.58	5.17	(chloromethyl) benzene; α-chlorotoluene; CAS #100-44-7	1/—/1 [20,23]
Bromoform ($CHBr_3$)	252.75	10.33	tribromomethane; CAS #75-25-2	0.5/—/0.5 (skin) [20]
Carbon tetrachloride* (CCl_4)	153.84	6.29	tetrachloromethane; CAS #56-23-5	10, C 25/C 2/5 (skin) [20,24]
Chlorobenzene (C_6H_5Cl)	112.56	4.60	monochlorobenzene; phenyl chloride; CAS #108-90-7	75/—/75 [20]
Chlorobromomethane (CH_2BrCl)	129.39	5.29	bromochloromethane; Halon 1011; CAS #74-97-5	200/—/200, STEL 250 [20]
Chloroform* ($CHCl_3$)	119.39	4.88	trichloromethane; CAS #67-66-3	C 50/C 2/10 [20,25]
o-Dichlorobenzene ($1,2-C_6H_4Cl_2$)	147.00	6.01	1,2-dichlorobenzene; CAS #95-50-1	50/—/C 50 [20]
p-Dichlorobenzene ($1,4-C_6H_4Cl_2$)	147.00	6.01	1,4-dichlorobenzene; CAS #106-46-7	75/—/75, STEL 110 [20]
1,1-Dichloroethane (CH_3CHCl_2)	98.96	4.05	ethylidene chloride; CAS #75-34-3	100/100/200, STEL 250 [20,21]
1,2-Dichloroethylene ($ClCH=CHCl$)	96.94	3.96	acetylene dichloride; 1,2-dichloroethene; CAS #540-59-0	200/—/200, STEL 250 [20]
Ethylene dichloride* ($ClCH_2CH_2Cl$)	98.96	4.05	1,2-dichloroethane; CAS #107-06-2	50, C 100/5, C 15/10 [20,21,26]
Hexachloroethane* (CCl_3CCl_3)	236.74	9.68	perchloroethane; CAS #67-72-1	1 (skin)/—/10 [20,21]
Methylchloroform (CH_3CCl_3)	133.42	5.45	1,1,1-trichloroethane; CAS #71-55-6	350/C 350/350, STEL 450 [20,21,27]
Tetrachloroethylene ($Cl_2C=CCl_2$)	165.83	6.78	perchloroethylene; CAS #127-18-4	100, C 200, P 300/—/ 50, STEL 200 [20,28]
1,1,2-Trichloroethane (Cl_2CHCH_2Cl)	133.41	5.45	vinyl trichloride; CAS #79-00-5	10 (skin)/—/10 (skin) [20,21]
1,2,3-Trichloropropane ($CH_2ClCHClCH_2Cl$)	147.43	6.03	allyl trichloride; glycerol trichlorohydrin; CAS #96-18-4	50/—/50, STEL 75 [20]

*Suspect carcinogen [20,21,22].

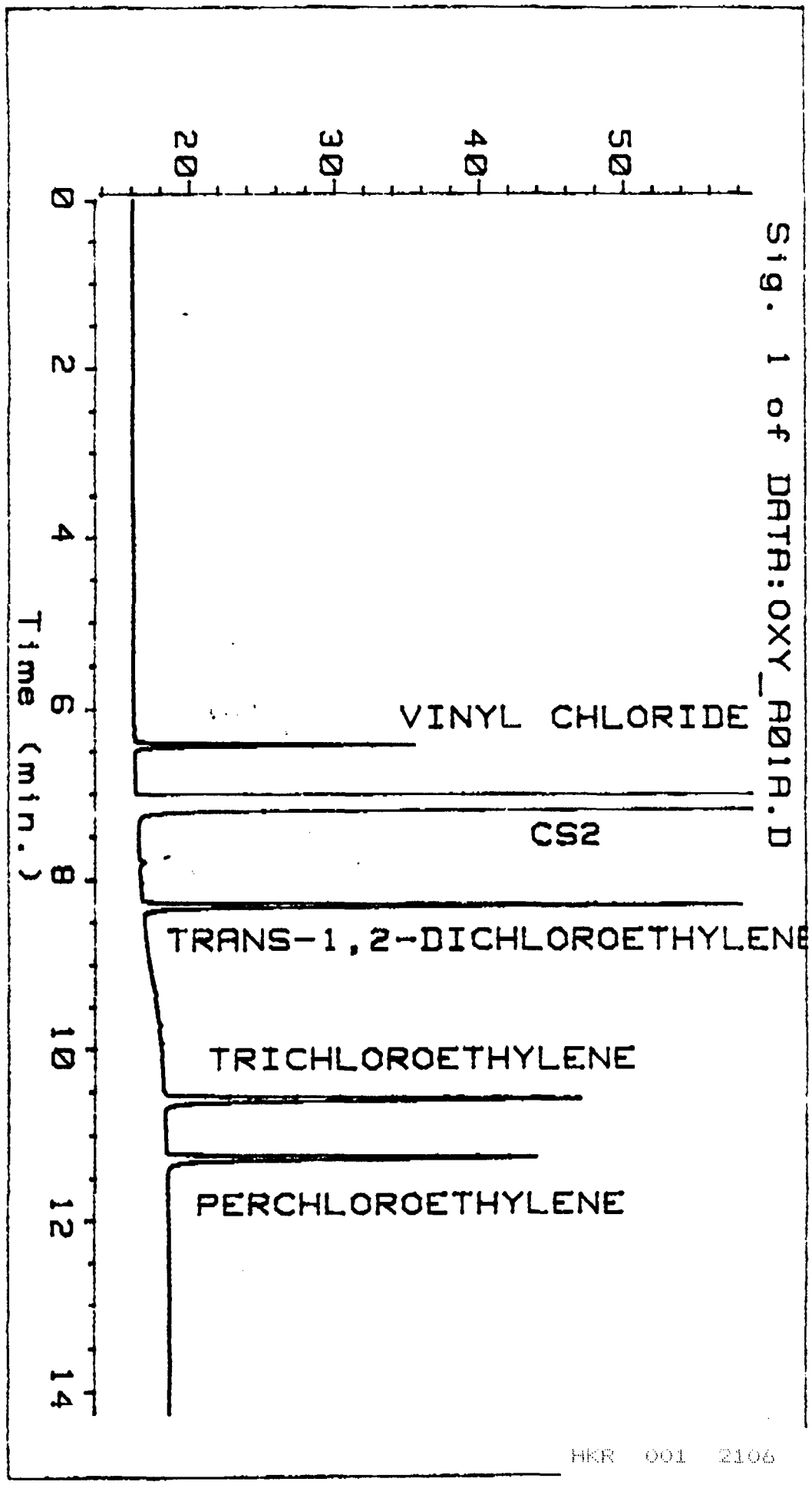
Table 2. Sampling limits.

Compound	Air Sample Volume (L) Min	Max	Target	Working Range, ppm, at Max Sample Volume
Benzyl chloride	6 @ 1 ppm	50	10	0.6 to 5.8
Bromoform	4 @ 0.5 ppm	70	10	0.2 to 4
Carbon tetrachloride	3 @ 10 ppm	150	15	2 to 105
Chlorobenzene	1.5 @ 75 ppm	40	10	10 to 430
Chlorobromomethane	0.5 @ 200 ppm	8	5	18 to 450
Chloroform	1 @ 50 ppm	50	15	2 to 190
o-Dichlorobenzene	1 @ 50 ppm	60	3	16 to 1100
p-Dichlorobenzene	1 @ 75 ppm	10	3	27 to 330
1,1-Dichloroethane	0.5 @ 100 ppm	15	10	4 to 250
1,2-Dichloroethylene	0.2 @ 200 ppm	5	3	16 to 560
Ethylene dichloride	1 @ 50 ppm	50	3	16 to 1320
Hexachloroethane	3 @ 1 ppm	70	10	0.3 to 8.3
Methylchloroform	0.1 @ 350 ppm	8	3	18 to 1450
Tetrachloroethylene	0.2 @ 100 ppm	40	3	9 to 1900
1,1,2-Trichloroethane	2 @ 10 ppm	60	10	1.8 to 64
1,2,3-Trichloropropane	0.6 @ 50 ppm	60	10	3 to 310

Table 3. Measurement parameters.

Compound	Column*	t (°C) Column/Injector/Detector	Range (mg per sample)
Benzyl chloride	A	160/170/210	0.02 to 0.15
Bromoform	A	130/170/210	0.02 to 0.15
Carbon tetrachloride	B	60/155/200	0.2 to 7
Chlorobenzene	A	105/190/250	0.4 to 10
Chlorobromomethane	A	80/170/210	0.5 to 15
Chloroform	B	75/155/200	0.4 to 11
o-Dichlorobenzene	C	140/225/250	0.1 to 3
p-Dichlorobenzene	A	140/225/275	0.2 to 4
1,1-Dichloroethane	A	50/100/175	0.4 to 12
1,2-Dichloroethylene	A	60/170/210	0.2 to 7
Ethylene dichloride	C	70/225/250	0.1 to 4
Hexachloroethane	D	110/170/210	0.02 to 0.3
Methylchloroform	C	70/225/250	0.6 to 17
Tetrachloroethylene	C	90/225/250	0.4 to 12
1,1,2-Trichloroethane	C	70/250/225	0.05 to 2
1,2,3-Trichloropropane	E	160/180/230	0.3 to 9

*A = 3 m x 3 mm OD stainless steel, 10% SP-1000 on 80/100 mesh Chromosorb WHP.
B = 6 m x 3 mm OD, otherwise same as A.
C = 3 m x 3 mm OD stainless steel, 10% OV-101 on 100/120 mesh Chromosorb WHP.
D = 3 m x 6 mm OD glass, 3% SP-2250 on 80/100 mesh Chromosorb WHP.
E = 3 m x 3 mm OD stainless steel, 10% FFAP on 80/100 mesh Chromosorb WHP.


20
30
40
50
0
2
4
6
8
10
12
14
Time (min.)
Sig. 1 of DATA:OXY_A01A.D
VINYL CHLORIDE
CS2
TRANS-1,2-DICHLOROETHYLENE
TRICHLOROETHYLENE
PERCHLOROETHYLENE

DATA:OXY.M

[METHOD]
26 Jul 88 9:50 am
DATA:OXY.M

[APPLICATIONS]

GCACQ	DATA:OXY.A	YES
DATAED	DATA:OXY.E	YES
REPORT	DATA:OXY.P	YES

[DATA FILES]

RAWDATA	DATA:OXY.D
INTEGRATION	DATA:DEFAULT.I
CALIBRATION	
REPORT	

DATA:OXY.A

Description: CHLORINATED SEPARATION 60 METER CAPILLARY
Last Changed By: TOM OBERSTAR
Date Last Changed: 26 Jul 88 2:40 pm

* HP 5890A Injection Port Setpoints Automatic injection

Injection Port A: Split/Splitless	Injection mode: Split mode
Injector A Temp: 250	Zone is : On

* HP 7673A Controller Setpoints

Injector A:	Installed	Injector B:	Not Installed
Sampler Tray:	Installed		
Sample Washes:	5	Viscosity:	0
Sample Pumps:	6	Sample Volume:	3
Solvent A Washes:	5	Solvent B Washes:	0

* Oven Temperature Program:

Oven Temp:	50	Cryo:	Not Installed
Initial Temp:	50	Initial Time:	0.50
Rate:	5		
Final Temp:	75	Final Time:	0.50
Rate A:	20		
Final Temp A:	140	Final Time A:	5.00

Equilibrium Time: 1.00

* HP 5890A Detector Setpoints

Detector A: FID		R.I. Column A:	Not Present
Detector A Temp:	250	Zone is :	On
Detector B: FID		R.I. Column B:	Not Present
Detector B Temp:	250	Zone is :	On

* HP 5890A Signal Setpoints

Signal 1: Detector A	Signal is: On
Signal 2: Off	

* Crt Plot Setpoints

Crt Time Window: 5.00
Crt Attn: 2^ 10
Crt Offset: 5 %
Minimum Peak Width: 0.040 min

DATA:OXY.E

*** Integrator Events ***

Initial	Peak Width	0.020
Initial	Threshold	0
Initial	Area Reject	0
	Shoulders OFF	

DATA:OXY.P

Report Destination: PRINTER

Report Type: Area Percent

Sort By: Signal

Sequence Macro File: DATA:GCTEST.K
******** Listing Complete ********

EQUIPMENT SPECIFICATIONS
CHARCOAL TUBES FOR NIOSH Method 1003

Application:	Collection of volatile organic compound in air
Supplier:	SKC
Dimensions:	10 mm dia x 110 mm long
Sections:	2
Sorbent mg:	400/200
Cartridge Ends:	Sealed glass

EQUIPMENT SPECIFICATIONS
TEFLON FILTERS FOR NIOSH METHOD 5503

Application:	Collection of particle associated semivolatile organic compounds
Supplier:	SKC
Dimensions:	13mm diameter
Pore Size:	1.0 um
Material:	Polytetra fluoroethylene

FLORISIL CARTRIDGE FOR NIOSH METHOD 5503

Application:	Collection of semivolatile organic compounds
Supplier:	SKC
Dimensions:	8mm diameter x 100mm/long
Sections:	2
Sorbent mg:	50/100
Cartridge Ends:	Sealed glass

SAMPLING AND ANALYSIS: Polychorobiphenyls Using NOISH Method 5503

FORMULA: mixture: $C_{12}H_{10-x}Cl_x$ [where x = 1 to 10]
M.W.: ca. 258 (42% Cl ; $C_{12}H_7Cl_2$);
ca. 326 (54% Cl ; $C_{12}H_5Cl_5$)

POLYCHLOROBIPHENYLS
METHOD: 5503
ISSUED: 2/15/84
REVISION #1: 8/15/87

OSHA: 1 mg/m³ (42% Cl); 0.5 mg/m³ (54% Cl)
NIOSH: 0.001 mg/m³ [1,2]
ACGIH: 1 mg/m³ (42% Cl); STEL 2 mg/m³
0.5 mg/m³ (54% Cl); STEL 1 mg/m³ (skin)

PROPERTIES:
42% Cl: BP 325 to 366 °C; MP -19 °C; d 1.38 g/mL @ 25 °C; VP 0.01 Pa (8 x 10^{-5} mm Hg; 1 mg/m³) @ 20 °C [3]
54% Cl: BP 365 to 390 °C; MP 10 °C; d 1.54 g/mL @ 25 °C; VP 0.0004 Pa (3 x 10^{-6} mm Hg; 0.05 mg/m³) @ 20 °C [3,4]

SYNONYMS: PCB; CAS #1336-36-3; 1,1'-biphenyl chloro (CAS #27323-18-8); chlorodiphenyl, 42% Cl (Aroclor 1242; CAS #53469-21-9), and 54% Cl (Aroclor 1254; CAS #11097-69-1)

SAMPLING

SAMPLER: FILTER + SOLID SORBENT (13-mm glass fiber + Florisil, 100 mg/50 mg)

FLOW RATE: 0.05 to 0.2 L/min or less

VOL-MIN: 1 L @ 0.5 mg/m³
-MAX: 50 L

SHIPMENT: transfer filters to glass vials after sampling

SAMPLE STABILITY: unknown for filters; 2 months for Florisil tubes [5]

BLANKS: 10% of samples

ACCURACY

RANGE STUDIED: not studied

BIAS: none identified

OVERALL PRECISION (s_r): not evaluated

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, ECD (^{63}Ni)

ANALYTE: polychlorobiphenyls

DESORPTION: filter + front section, 5 mL hexane; back section, 2 mL hexane

INJECTION VOLUME: 4 µL with 1-µL backflush

TEMPERATURE-INJECTION: 250 - 300 °C
-DETECTOR: 300 - 325 °C
-COLUMN: 180 °C

CARRIER GAS: N_2, 40 mL/min

COLUMN: glass, 1.8 m x 2 mm ID, 1.5% OV-17/1.95% QF-1 on 80/100 mesh Chromosorb WHP

CALIBRATION: standard PCB mixture in hexane

RANGE: 0.4 to 4 µg per sample [6]

ESTIMATED LOD: 0.03 µg per sample [6]

PRECISION (s_r): 0.044 [5]

APPLICABILITY: The working range is 0.01 to 10 mg/m³ for a 40-L air sample [5]. With modifications, surface wipe samples may be analyzed [7,8].

INTERFERENCES: Chlorinated pesticides, such as DDT and DDE, may interfere with quantitation of PCB. Sulfur-containing compounds in petroleum products also interfere [9].

OTHER METHODS: This method revises Methods S120 [10], 5503 (dated 2/15/84), and P&CAM 244 [5]. Methods S121 [11] and P&CAM 253 [12] for PCB have not been revised.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least five working standards over the range 10 to 500 ng PCB/mL.
   a. Add known amounts of stock standard solution to hexane in 10-mL volumetric flasks and dilute to the mark.
   b. Analyze together with samples and blanks (steps 11 and 12).
   c. Prepare calibration graph (sum of areas of selected peaks vs. ng PCB/mL).
9. Determine desorption efficiency (DE) at least once for each lot of glass fiber filters and Florisil used for sampling in the calibration range (step 8). Prepare three tubes at each of five levels plus three media blanks.
   a. Remove and discard back sorbent section of a media blank Florisil tube.
   b. Inject known amounts of stock standard solution directly onto front sorbent section and onto a media blank filter with a microliter syringe.
   c. Cap the tube. Allow to stand overnight.
   d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
   e. Prepare a graph of DE vs. µg PCB recovered.
10. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 5503-1. Inject sample aliquot manually using solvent flush technique or with autosampler.
    NOTE 1: Where individual identification of PCB is needed, a procedure using a capillary column may be used [14].
    NOTE 2: If peak area is above the linear range of the working standards, dilute with hexane, reanalyze and apply the appropriate dilution factor in calculations.
12. Sum the areas for five or more selected peaks.

CALCULATIONS:

13. Determine the mass, ng (corrected for DE) of PCB found on the glass fiber filter (w) and in the Florisil front (W_f) and back (W_b) sorbent sections, and in the average media blank filter (B) and front (B_f) and back (B_b) sorbent sections.
    NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.
14. Calculate concentration, C, of PCB in the air volume sampled, V (L):

$$C = \frac{(W + W_f + W_b - B - B_f - B_b) \cdot 10^{-3}}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

This method uses 13-mm glass fiber filters which have not been evaluated for collecting PCB. In Method S120, however, Aroclor 1242 was completely recovered from 37-mm glass fiber filters using 15 mL isooctane [12,15,16]. With 5 mL of hexane, Aroclor 1016 was also completely recovered from 100-mg Florisil beds after one-day storage [5]. Thus, with no adsorption effect likely on glass fiber filters for PCB, 5 mL hexane should be adequate to completely extract PCB from combined filters and front sorbent sections. Sample stability on glass fiber filters has not been investigated. Breakthrough volume was >48 L for the Florisil tube at 75% RH in an atmosphere containing 10 mg/m³ Aroclor 1016 [5].

REFERENCES:

[1] Criteria for a Recommended Standard...Occupational Exposure to Polychlorinated Biphenyls, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-225 (1977).

EQUIPMENT SPECIFICATIONS
DU PONT ALPHA-1 AIR SAMPLER

Application:	Low-flow personal sampling pump
Pump Type:	Dual opposed diaphagm
Flow Rate Range:	5-5000 cc/min constant flow
Preserve Drop Capability:	25" W.C. maximum
Control Capability:	Microprocessor controlled for: • run time • start time • tolerated restricted flow time • flow rate readout • average air temp. readout
Constant Flow Control:	±5% of set flowrate
Power:	Internal rechargable battery pack
Dimensions:	2-1/4" x 4" x 5"

EQUIPMENT SPECIFICATIONS
FILTERS FOR NIOSH 0500

Application:	Collection of total respirable particulates in air
Supplier:	SKC
Dimensions:	37 mm diameter
Pore size:	5.0 µm
Material:	Polyvinyl Chloride
Catalog Number:	225-8

EQUIPMENT SPECIFICATIONS

CHARCOAL TUBES FOR NIOSH Method 1003

Application:	Collection of volatile organic compounds in air
Supplier:	SKC
Dimensions:	10 mm dia x 110 mm long
Sections:	2
Sorbent mg:	50/100
Cartridge Ends:	Sealed glass
Catalog Number:	226-16

CALIBRATION OF THE DUPONT ALPHA-1

1.0 Applicability

This procedure describes the steps necessary for calibration of the DuPont, Alpha-1 Sampling Pump.

2.0 Responsibilities

The site technician or field operator will be responsible for calibrating the DuPont Alpha-1 at the frequency required in the Project Work Plan.

3.0 Supporting Materials

- DuPont Calibrator Case (or other standard bubble tube calibrator with stop watch)
- Two indicating rotameters - 0-500 cc/min and 0-5000 cc/min
- Mercury thermometer
- Aneroid Barometer (or other means of obtaining local, barometric air pressure)
- Calibration Data Sheet

4.0 Procedure

4.1 Determine the flow rate and the type of sampling media that will be used for sampling.

4.2 Record the date, time, project #, sample media type, pump serial number, ambient temperature and barometric pressure on the calibration data sheet.

4.3 Turn "on" the Alpha-1 by pressing the On/Off and Hold/Run push buttons.

4.4 Set the flow rate for the Alpha-1 to the desired flow range as follows:

- Low-Flow Range (5-1000 cc/min)

  a. Open the bypass valve fully by turning it three turns counterclockwise from the fully closed position.
  b. Close the high-flow valve completely by gently turning it clockwise until it seats.

c. Adjustment for the desired flow rate will be made using the low-flow valve. (The high-flow valve may have to be opened slightly if the desired flow rate cannot be attained using the low-flow valve by itself.)

o High-Flow Range (1000-5000 cc/min)

a. Close the bypass valve completely by gently turning it clockwise until it seats.

b. Adjustment for the desired flow rate will be made by using the high-flow valve. The low-flow valve may be used as a "fine tuning" control.

4.5 In order to simulate the pressure drop that will be encountered during sampling, attach a sample line along with the type of sample collection media that will be utilized for sampling, to the inlet of the pump.

4.6 Measure the flow rate through the sampling system with the respective rotameter and adjust the flow control valve to read the approximate desired flow rate. Allow 10 to 15 seconds after adjustment for the flow control mechanism to respond.

4.7 Remove the rotameter. Wet down the inside of the bubble tube with soap solution by allowing several bubbles to pass up the full length of the bubble tube. Attach the bubble tube to the pump sample line and collection media system.

4.8 Determine the observed volume flow rate. Use a stopwatch to measure the time it takes for one bubble to rise between any two graduated marks. The observed volume is the value difference from one mark to another. This volume divided by the elapsed time will equal the observed flow rate. (The bubble must be allowed to travel at least one liter while being timed with the stopwatch.)

Flow Rate = Volume/Time

4.9 If the flow rate needs adjustment, repeat the procedure in 4.6 through 4.8 until the desired flow rate is obtained.

4.10 After all adjustments, if any, are completed, run five individual tests with the bubble meter, average the flows, and record the volume and elapsed time on the calibration data sheet.

CALIBRATION OF THE DUPONT ALPHA-1

4.11 Determine the standard flow rate as follows:

4.11.1 Average the run times for the five tests completed in 4.10 above and record on the calibration data sheet.

4.11.2 Determine the flow rate at standard conditions, (760 mm Hg, 25°C, and 0% water vapor), using the equation below:

$$\text{Standard Flow Rate} = \frac{\text{Vol (ml)}}{\text{Time (min)}} \times \frac{(P-P_v)}{760} \times \frac{298.16}{(273 + T)}$$

where

P = atmospheric pressure, mm Hg
P_v = vapor pressure of water, mm Hg (see Table 4.1)
T = temperature of gas, °C

4.11.3 Record the initial flow rate at standard conditions on the data sheet.

4.12 Disconnect the sample line and sample collection media from the pump.

4.13 The pump is now calibrated and ready for field use. (Note: All pumps should remain running until sampling is completed. Turning the pumps off may affect the calibrated flow rate.)

4.14 Following the sampling period, and before turning the pumps "off" a final flow calibration check will be completed. This will be done by repeating steps 4.7, 4.8, 4.10, 4.11 and 4.12 and, without making any adjustments, record necessary information on the calibration data sheet.

4.15 The average standard flow rate is determined by averaging the pre-test standard flow rate with the post-test standard flow rate.

5.0 Acceptance Criteria

5.1 All blank spaces on the calibration data sheet will be filled out or marked "NA".

5.2 The pre-test standard flow rate must agree with the post-test standard flow rate to within ±10%. If it does not, re-run the post-calibration tests and re-check temperature readings, pressure readings, and all calculations. If repeated validations of the post calibration test result in flow differentials of >10% then the average standard flow rate should be treated as suspect. If the corresponding sample is selected for actual analyses then the resulting values should be treated as approximate concentrations.

6.0 Document Submission

6.1 All calibration data sheets will be submitted to the program manager or field coordinator within 3 days.

CALIBRATION OF THE DUPONT ALPHA-1

Table 4-1

SATURATION VAPOR PRESSURE OVER WATER (^{o}C, mm Hg)[a]

Values for Fractional Degree Between 50 and 89 Were Obtained By Interpolation

Temp °C	0.0	0.2	0.4	0.6	0.8	Temp °C	0.0	0.2	0.4	0.6	0.8
-15	1.436	1.414	1.393	1.368	1.345	42	61.50	62.14	62.80	63.46	64.12
-14	1.560	1.534	1.511	1.488	1.466	43	64.80	65.48	66.16	66.86	67.56
-13	1.691	1.665	1.637	1.611	1.585	44	68.26	68.97	69.69	70.41	71.14
-12	1.844	1.804	1.776	1.748	1.720						
-11	1.987	1.955	1.924	1.893	1.863	45	71.88	72.62	73.38	74.12	74.88
						46	73.65	74.43	77.21	78.00	78.80
-10	2.149	2.116	2.084	2.050	2.018	47	79.60	80.41	81.23	82.05	82.87
- 9	2.326	2.290	2.254	2.219	2.184	48	83.71	84.56	85.42	86.28	87.14
- 8	2.514	2.475	2.437	2.399	2.362	49	88.02	88.90	89.79	90.69	91.58
- 7	2.715	2.674	2.633	2.593	2.553						
- 6	2.931	2.887	2.843	2.800	2.757	50	92.51	93.5	94.4	95.3	96.3
						51	97.20	98.2	99.1	100.1	101.1
- 5	3.163	3.115	3.068	3.022	2.976	52	102.09	103.1	104.1	105.1	106.2
- 4	3.410	3.358	3.308	3.259	3.211	53	107.20	108.2	109.3	110.4	111.4
- 3	3.673	3.618	3.567	3.514	3.461	54	112.51	113.6	114.7	115.8	116.9
- 2	3.956	3.898	3.841	3.785	3.730						
- 1	4.258	4.196	4.135	4.075	4.016	55	118.04	119.1	120.3	121.5	122.6
						56	123.88	125.0	126.2	127.4	128.6
- 0	4.579	4.513	4.448	4.385	4.320	57	129.82	131.0	132.3	133.5	134.7
						58	136.08	137.3	138.5	139.8	141.2
0	4.579	4.647	4.715	4.785	4.856	59	142.60	143.9	145.2	146.6	148.0
1	4.926	4.998	5.070	5.144	5.219						
2	5.294	5.370	5.447	5.525	5.604	60	149.38	150.7	152.1	153.5	155.0
3	5.685	5.766	5.848	5.931	6.015	61	156.41	157.8	159.3	160.8	162.3
4	6.101	6.187	6.274	6.363	6.453	62	163.77	165.2	166.8	168.4	169.8
						63	171.38	172.9	174.5	176.1	177.7
5	6.543	6.635	6.728	6.822	6.917	64	179.31	180.9	182.5	184.2	185.8
6	7.013	7.111	7.209	7.309	7.411						
7	7.513	7.617	7.722	7.828	7.936	65	187.54	189.2	190.9	192.6	194.3
8	8.045	8.156	8.267	8.380	8.494	66	196.09	197.8	199.5	201.3	203.1
9	8.609	8.727	8.845	8.965	9.086	67	204.98	206.8	208.6	210.5	212.3
						68	214.17	216.0	217.9	219.8	221.8
10	9.209	9.333	9.458	9.585	9.714	69	223.73	225.7	227.7	229.7	231.7
11	9.844	9.976	10.109	10.244	10.380						
12	10.518	10.658	10.799	10.941	11.085	70	233.7	235.7	237.7	239.7	241.8
13	11.231	11.379	11.528	11.680	11.833	71	243.9	246.0	248.2	250.3	252.4
14	11.987	12.144	12.302	12.463	12.626	72	254.6	256.8	259.0	261.2	263.4
						73	265.7	268.0	270.2	272.5	274.8
15	12.788	12.953	13.121	13.290	13.461	74	277.2	279.4	281.8	284.2	286.6
16	13.634	13.809	13.987	14.168	14.347	75	289.1	291.5	294.0	296.4	298.8
17	14.530	14.715	14.903	15.092	15.284	76	301.4	303.8	306.4	308.9	311.4
18	15.477	15.673	15.871	16.071	16.272	77	314.1	316.6	319.2	321.8	324.4
19	16.477	16.685	16.894	17.105	17.319	78	327.3	330.0	332.8	335.5	338.2
						79	341.0	343.8	346.6	349.4	352.2
20	17.535	17.753	17.974	18.197	18.422						
21	18.650	18.880	19.113	19.349	19.587	80	355.1	358.0	361.0	363.8	366.8
22	19.827	20.070	20.316	20.565	20.815	81	369.7	372.6	375.6	378.5	381.5
23	21.068	21.324	21.583	21.845	22.110	82	384.6	387.6	390.7	393.4	397.4
24	22.377	22.648	22.922	23.198	23.476	83	400.6	403.8	407.0	410.2	413.6
						84	416.8	420.2	423.6	426.8	430.2
25	23.756	24.039	24.325	24.617	24.912	85	433.6	437.0	440.4	444.0	447.5
26	25.208	25.508	25.812	26.117	26.426	86	451.0	454.4	458.0	461.6	465.2
27	26.738	27.054	27.374	27.698	28.021	87	468.7	472.4	476.0	479.8	483.6
28	28.348	28.680	29.018	29.358	29.697	88	487.1	491.0	494.7	498.5	502.2
29	30.043	30.398	30.760	31.128	31.484	89	508.1	510.0	513.9	517.8	521.8
30	31.824	32.191	32.561	32.934	33.312	90	525.78	529.77	533.80	537.86	541.96
31	33.686	34.062	34.471	34.884	35.301	91	546.03	550.18	554.33	558.53	562.75
32	35.652	36.048	36.477	36.901	37.388	92	566.99	571.28	575.61	579.97	584.37
33	37.729	38.135	38.584	39.018	39.457	93	588.80	593.28	597.81	602.39	606.98
34	39.898	40.344	40.796	41.251	41.710	94	610.98	615.64	620.01	624.61	629.24
35	42.175	42.644	43.117	43.596	44.078	95	633.90	638.79	643.73	648.69	653.69
36	44.563	45.054	45.549	46.050	46.556	96	657.92	662.97	668.07	673.20	678.37
37	47.067	47.582	48.102	48.627	49.157	97	682.57	687.84	693.16	698.53	703.94
38	49.692	50.231	50.774	51.323	51.879	98	707.77	713.46	719.21	725.01	730.86
39	52.442	53.009	53.580	54.158	54.742	99	736.76	742.71	748.71	754.76	760.86
40	55.324	55.91	56.51	57.11	57.72	100	766.98	773.15	779.37	785.64	791.96
41	58.34	58.96	59.58	60.22	60.86	101	797.33	803.76	810.24	816.78	823.37

[a] Handbook of Chemistry and Physics, 45th Edition, Chemical Rubber Publishing Company, 1965.

DUPONT ALPHA-1 CALIBRATI ATA SHEET

PROJECT #:_____

LOCATION:_____

DATE:_____

SAMPLE MEDIA TYPE:_____

BUBBLE TUBE S/N:_____

	PRE-TEST	POST-TEST
TIME:	_____	_____
BAROMETRIC PRESS. (mm Hg):	_____	_____
VAPOR PRESS. (mm Hg):	_____	_____
TEMP. (DEG C):	_____	

		PRE-TEST								POST-TEST							AVERAGE	
p S/N	Volume (mL)	Run Time Run 1	Run 2	Run 3	Run 4	Run 5	Ave (sec)	Ave (min)	Standard Flow Rate	Run 1	Run 2	Run 3	Run 4	Run 5	Ave (sec)	Ave (min)	Standard Flow Rate	Standard Flow Rate

DO PRE-TEST AND POST-TEST STANDARD FLOW RATES FOR EACH PUMP AGREE WITHIN + OR - 10% ? ____Y____N

ARE ALL CALIBRATIONS AND DATA CLEARLY DOCUMENTED ? ____Y____N

DATE:_____TIME:_____TECHNICIAN:_____

$$\text{STANDARD FLOW RATE} = \frac{\text{VOL (mL)}}{\text{TIME (min)}} \times \frac{(P - Pv)}{760} \times \frac{298.16}{(273 + T)}$$